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**THE ROYAL
NATURAL HISTORY**



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THE ROYAL NATURAL HISTORY

EDITED BY

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GAMBIER BOLTON, F.Z.S.; AND MANY OTHERS

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CHAPTER XI.

BATS,—*concluded*.

THE FREE-TAILED INSECTIVOROUS BATS.

THE chief distinctive features of this group are that, as a rule, the tail (when present) either penetrates the membrane between the legs, so that its extremity appears on the upper surface, or it is produced considerably beyond the hinder margin; secondly, that the innermost (frequently the only) pair of upper incisor teeth are generally of large size, and placed very close together; and, thirdly, that except in two genera, each represented by a single species, the first joint of the third or middle finger of the wing is, when at rest, folded back upon the upper surface of its supporting metacarpal, instead of being extended forwards in the same line, as in the species we have hitherto described. Not a single representative of this large assemblage of bats is found in the British Isles, and, indeed, only one species occurs within the limits of the European area. They are mainly characteristic of tropical and subtropical regions: but whereas the first of the two families into which they are divided ranges over both hemispheres, the second is strictly confined to the central and southern portions of the Western. The number of genera—to say nothing of species—included in the two families is very large, and as many of them are distinguished from one another by comparatively trivial characteristics, we shall notice only a few typical forms, of special interest either from peculiarities of structure or of habits.

THE SMOOTH-NOSED FREE-TAILED BATS.

Family *EMBALLONURIDÆ*.

The first family of the group occupies a position precisely similar to that held by the Typical Bats (*Vespertilionidæ*) in the other branch of the insect-eaters treated in the preceding section. In addition to the peculiar mode of folding the third finger of the wing, and the characters of the tail already alluded to, they are distinguished by the circumstance that there are but two bony joints in this third finger, as also by the absence of any distinct nose-leaf. As a rule, they have a small tragus in the ear, and only a single pair of upper incisor teeth, which incline towards one another. Moreover, the extremity of the snout is obliquely truncated from above downwards, so as to cause the nostrils to project more or less in front of the tip of the lower jaw. The family is widely distributed over the warmer regions of both the Eastern and Western Hemispheres, and includes one of the two species which are the only representatives of the entire

order (as, indeed, they are of the whole class of Mammals) found in New Zealand: but the range on either side is mainly restricted to the belt lying within thirty degrees of the Equator.

THE SHEATH-TAILED BATS.

Genus *Emballonura*.

The mountain sheath-tailed bat (*Emballonura monticola*) is a fairly well-known representative of a group of this family in which the tail is slender, and has its free extremity perforating the membrane between the hind legs, while the legs are relatively long, and the upper incisor teeth comparatively small and weak. The special characteristic of the genus is that there are two pairs of upper incisor teeth; the total number of teeth being 34, of which $\frac{2}{3}$ on each side belong to the incisor, and $\frac{1}{3}$ to the cheek series. The production of the muzzle is more or less strongly marked, the top of the head is flat, and the ears are not united, and have a tragus of somewhat oblong form, and expanded above.

The mountain sheath-tailed bat is of a chocolate-brown colour, and measures about $1\frac{1}{2}$ inches in length, exclusive of the tail. It is found in Java, Sumatra, Borneo, and the Philippines; the other four species of the genus inhabiting various islands in the region extending from Madagascar to the Navigator group. The genus is, therefore, exclusively an insular one, and, in this respect, quite peculiar. The Polynesian sheath-tailed bat (*E. semicaudata*) is found in the Mergui Archipelago lying off Tenasserim.

THE POUCH-WINGED BATS.

Genus *Saccopteryx*.

Omitting two small genera, we come to the remarkable pouch-winged bats (*Saccopteryx*) of Central and South America, which do not generally exceed 2 inches in length, and have fewer teeth than the foregoing; the number of incisors being $\frac{1}{2}$, and the cheek-teeth $\frac{3}{4}$ on each side. They derive their name from the presence of a peculiar glandular pouch on the under side of each wing, at or near the elbow-joint. These pouches, which are well developed in the males but rudimentary in the females, secrete a red-coloured strongly-smelling substance, which appears to act as a sexual attraction. In one species from British Guiana (*S. leptura*), these pouches are unusually large, and from each of them projects a prominent white frill of skin, which seems capable of being protruded and withdrawn at the will of the animal; the use of this is unknown. In Demerara these bats may be seen flying about quite close to the houses at dusk. Moseley relates that he caught an example of another species (*S. canina*) in Bahia, resting fast asleep on the bare bark of a large tree: the dense forest growth overhead making such an exposed situation quite dark enough for a resting-place throughout the day. Nearly all the six species have the fur of a uniform dark brown colour, although one has a reddish tinge.

THE TOMB-BATS.

Genus *Taphozous*.

These derive both their popular and scientific titles from one of the species being found in vast numbers in the ancient Egyptian tombs, where they were discovered during the first French Expedition to that country. The tomb-bats differ from the other members of the group in having only two pairs of incisor teeth in the lower jaw, and also by the circumstance that the upper pair of these teeth are shed in the adult state. Instead of the glandular pouches on the wings, characteristic of the preceding genus, most of these bats have pouches of a similar nature on the under-surface of the chin; these being chiefly, and in some cases exclusively, developed in the male sex. Many individuals, especially those taken during the hibernating season, have large deposits of fat around the root of the tail and the base of the thighs. This is probably for supporting life during the hibernating season, which, from the more northerly range of this species, would appear to be longer than among the other representatives of the genus.

The tomb-bats are found in Africa, India, Burma, the Malayan region, and Australia, but are unknown in Polynesia. Most of them are dwellers in caves, fissures in rocks, and old buildings; but one Indian species has been observed on the stem of a palm tree. Perhaps the best known species is the naked-bellied tomb-bat (*Taphozous nudiventris*), readily recognised by its tawny fur and the naked under-parts. It is a large species, measuring $3\frac{3}{4}$ inches in length, exclusive of the tail, the span of the wing being about 20 inches. This species is widely distributed over Africa, and is the one found in the Egyptian tombs, while it also extends into Syria and Palestine. According to Canon Tristram, the caves near the Sea of Galilee are inhabited by clouds of these bats.



HEAD OF TOMB-BAT.—After Dobson.

Writing of the Sumatran species (*T. affinis*), Mr. E. C. Buxton, as quoted by Dr. Dobson, states that at Telok Betong, in Sumatra, "there was an old, hollow cocoa-nut stump in the garden, and about twenty of these bats lived in it. At night, or rather early in the morning, they used to hang at the top of the verandah in company with several other kinds; and I found that they were all fruit-eaters, as there was a great deal of fruit-refuse under them." Although, as Dr. Dobson remarks, this by no means proves the tomb-bat to be at times a fruit-eater, as, for all we know, the fruit-refuse might have been deposited by its companions, yet that this is probably the case is indicated by the partially frugivorous habits of some of its American allies. The tail of the tomb-bats perforates the membrane between the legs near its centre, and thus has the tip freely projecting. At the will of the animal it can, however, be withdrawn almost completely within the membrane, which thus forms a kind of sheath.

THE WHITE BATS.

Genus *Dididurus*.

As white is a colour but rarely met with among the Chiroptera, we cannot pass over the white bats, which are represented only by two species from Central and South America. These bats are allied to the tomb-bats, but have three pairs of lower incisor teeth, and they are also distinguished from other bats by the presence of a peculiar pouch on the under side of the membrane between the legs. The typical white bat (*Dididurus albus*) has the fur on the body dark at the base, but the greater portion of each hair, up to the tip, is of a yellowish or creamy-white, while the whole of the wing-membranes are pure white. The first known specimen was found in Brazil reposing between the fronds of a cocoanut palm. If this be the normal habitat of the species, its coloration may perhaps be a protective one, adapted to resemble the silvery hue of the under-surface of the palm leaves. Here it may be mentioned that albino varieties of dark-coloured bats are occasionally met with; the most recently described example that has come under our notice being a white specimen of a species of *Vesperugo* (*V. capensis*), obtained in 1890 near Cape Town.

THE HARE-LIPPED BATS.

Genus *Noctilio*.

If the white bats are noteworthy on account of their colour, the two species of hare-lipped bats, which are likewise Central and South American forms, are deserving of mention on account of the curious superficial resemblances of their muzzles to those of the Rodents, while at least the ordinary species (*Noctilio leporinus*), which has been known since the time of Linnaeus, is not less remarkable from the peculiar nature of its diet. These bats derive their ordinary name from their curiously folded upper lip, which is bent upwards in the middle line in the form of an inverted V, terminated above by the nostrils. The feet and claws are remarkable for their large size. They have 28 teeth, of which there are 2 incisors, and 3 cheek-teeth on each side. The first, or innermost pair of upper incisor teeth, are of great size, and placed close together so as to conceal the small outer pair; and as the large ones bite against the single smaller pair of lower incisors, the resemblance to the mouth of a small Rodent, such as a mouse, is very striking.

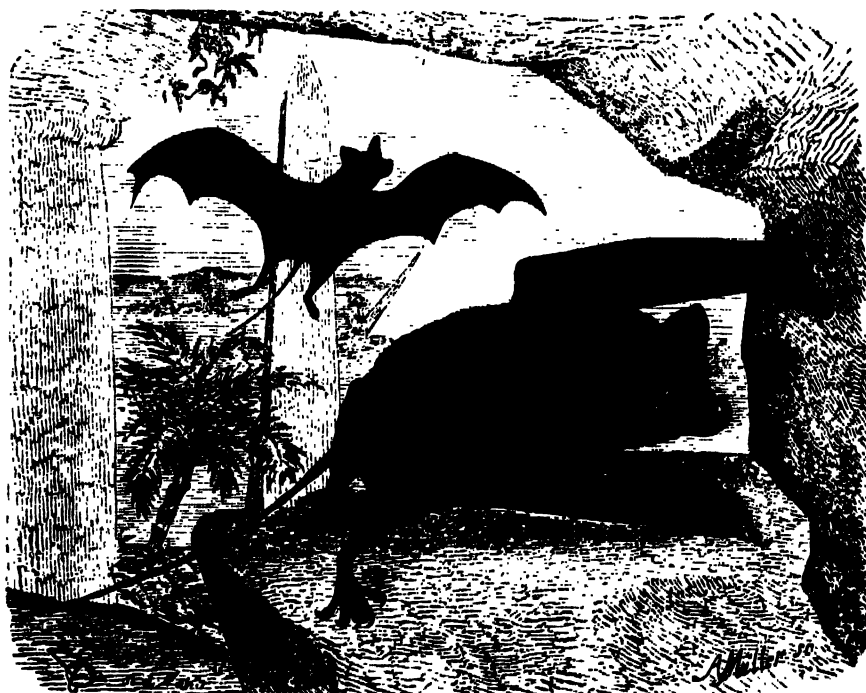
These bats appear to be almost omnivorous in their diet. That they would freely eat cockroaches was proved long ago by Mr. P. H. Gosse, when in Jamaica; and it was at the same time shown that they would chew, although not swallow, the flesh of small birds. In 1859, a Mr. Fraser, writing from Ecuador, stated that they had a very peculiar and offensive fishy smell, and that he had observed them "skimming the bank of the river, every now and then making a dash along, and actually striking the water, catching the minute shrimps as they pass up stream." It was not, however, till 1880, that it was definitely known that they actually caught and fed upon small fish. Professor M'Carthy, who made special investigations to determine the truth of their alleged fish-eating habits, writes to Mr. J. E.

Harting, that in December 1888 he visited a cave in an island near Menoa. "This cave is in a soft shale formation, and the top of the opening is about seven feet from the water at full tide. The bats were then in an active state, and the majority appeared to be flying homewards. There were few fish near the surface of the water, and comparatively little local fishing appeared to be going on. An occasional 'swish' now and again far out proved that the bats were trying to secure their prey. Five homeward-bound specimens were secured in the cave, about twelve yards from the mouth. The stomach of one specimen opened within half an hour contained much fish in a finely-divided and partially digested state. On the morning of the 31st I visited the cave from which the specimens were procured at 3 A.M., and found that the bats had apparently forgotten the previous disturbance. They came flying in in dozens, and two specimens were secured. Both contained considerable quantities of fish. I have opened several other specimens of these bats, and in the majority of cases fish-scales were found; but the stomachs of two were perfectly empty. This might be attributed to the absence of the desired fish in the locality."

THE LONG-TAILED BAT.

Genus *Rhinopoma*.

The last, and at the same time not the least, noteworthy member of the present subfamily, is the long-tailed bat (*Rhinopoma microphyllum*), which is found from



LONG-TAILED BAT (nat. s.)

North-East Africa, through India, to Burma. It has 28 teeth, of which $\frac{1}{2}$ on each side belong to the incisor, and $\frac{1}{3}$ to the cheek series. Its most distinctive feature is, however, its very long and slender free tail, which projects far beyond the margin of the very short membrane between the legs, and thereby distinguishes it at a glance from all other bats. It is further quite peculiar in that the second or index finger of the wing has two joints. Another feature, of less import, although that which has given the scientific name to the genus, is the presence of a fleshy prominence on the muzzle, just over the nose; this prominence having been incorrectly regarded as a rudimentary nose-leaf. In specimens taken in India during the cold season, there is an enormous accumulation of fat around the tail and thighs, which is sometimes so large as to exceed the weight of the rest of the body; the accumulation being similar to that already noticed as occurring in the naked-bellied tomb-bat and doubtless serving the same purpose. According to Mr. Blanford, "this species is common in North-Western India, and hides during the day in caves, clefts in rocks, old ruins, and similar places. In Cutch it takes up its abode in wells. Jerdon relates that in Madras, in 1848, many were captured in a house for three successive nights, having probably been blown by strong westerly winds from the rocky hills to the westward. The species is not of common occurrence in Madras. According to Blyth, this species formerly abounded in the Taj at Agra (it may still be found there), and Cantor found numbers inhabiting the subterranean Hindu place of worship within the fort at Allahabad."

THE MASTIFF-BATS.

Genus *Molossus*.

With the mastiff-bats, which take their name from a supposed resemblance of their broad wide-mouthed muzzles to the head of a mastiff, we come to the first representatives of the second subfamily of this division, the members of which are



HEAD OF MASTIFF-BAT. (From Dobson, *Proc. Zool. Soc.*, 1878.)

characterised by the thickness of their tails, which (with a single exception) are prolonged for a considerable distance beyond the hinder margin of the membrane between the hind legs. The legs are short and strong, and the feet of great relative width; while the thumbs of the wings have curious callosities at their bases; and the upper incisor teeth are of large size, and limited to a single pair. As in all these bats, the feet are completely free from the wing-membranes, which can be comfortably folded up and stored away between the fore-arms and the legs, and the membrane between the legs can be retracted to a greater or less extent by being moved backwards

and forwards along the tail. In the strength of their limbs, in the development of the corn-like callosities at the bases of their thumbs, as well as in their large and flat feet, and the freedom of their feet from the wing-membranes, the mastiff-bats and their allies are more adapted for crawling on the ground than any other members of this group of animals. And the result of observations on living

specimens has been to confirm these inductions, made upon the evidence of structural peculiarities.

The mastiff-bats are an American group, found in the tropical and subtropical regions of both divisions of the Western Hemisphere. With the exception of two species, in which the number of the lower incisor teeth is reduced to a single pair, they have either 26 or 28 teeth, of which $\frac{1}{2}$ on either side are incisors, while the cheek-teeth number either 4 or $\frac{3}{4}$. The upper incisors are placed close together in the middle line: and the large ears, which have a small tragus (occasionally absent) are united by their inner margins. In common with two nearly allied genera of bats, they have very capacious lips, which in most of the species are thrown into a number of wrinkles or puckers; and they are further characterised by their long and slender wings. The great length and narrowness of the wings indicates, as Dr. Dobson observes, rapid flight: and since they also possess the power of varying the length of the membrane between the legs by a "roofing" process, they must have great dexterity in suddenly changing their direction, as when they are compelled to double in pursuing swiftly flying insects: and, again, their expansive and capacious lips aid the teeth in seizing and retaining the round and solidly armoured bodies of the larger beetles: so that it would seem that they are better adapted than any other members of the order for capturing insects of very swift flight.

Of the red mastiff-bat (*Molossus rufus*) an account is given by Mr. P. H. Gosse, from which it appears that this bat inhabits the roofs of houses and the hollow trunks of palm trees, where colonies of large size may sometimes be found. It is more active when on the ground than any other species; and, indeed, on such occasions its motions are so rapid that some dexterity is required to ensure its capture. In the act of running it rests on its wrists, with the fore-part of the body considerably raised. In the hollow stem of a palm tree, examined by another observer, it was found that while in one place the males of this species were collected together to a number approaching two hundred, in another spot the assemblage consisted almost entirely of females, with only a solitary male among them here and there. This distinction of the resting-places of the two sexes has also been noticed in certain other bats.

In describing the habits of another species, the chestnut mastiff-bat (*M. glaucinus*), Mr. Gosse writes that "soon after sunset we hear the scrambling of little claws along the plaster (in the loft above) gradually tending towards the point where the hole under the eaves is situated . . . I judge that they crawl along one after another in a straight line to the outlet, in parties. The family assured me that after the mastiff-bats had emerged a few hours, they invariably returned into the hole again; and they several times directed my attention to them when returning. They return between eight and nine o'clock, and issue forth again before the morning twilight. When handled, its impatience of confinement is manifested by a continuous screeching, not very loud, but exceedingly harsh and shrill. The ears are commonly so pendent as completely to cover the eyes; but they are occasionally retracted so as to expose the eyes, especially if the face be touched."

In certain parts of the Amazon Valley the mastiff-bats, together with some species belonging to the under-mentioned nose-leafed family, are so numerous as to

become a serious inconvenience to travellers. Thus when at Caripi, a station situated about twenty miles from Para, Bates narrates how for the first few nights of his stay he slept in a room with the roof open to the tiles and rafters, which had not been used for many months previously; and on the second night of his visit was awakened about midnight by the sudden rushing of swarms of bats flying around him. So numerous were they, that the air was alive with them: the lamp had been extinguished by the rush of their wings, but when relighted revealed the whole room blackened by their multitudes. The traveller proceeded to clear them out by laying about vigorously with a stick, and for a time succeeded in making the unwelcome intruders retire to the tiles and rafters. No sooner, however, was quiet restored than the bats reappeared in full force, and once more extinguished his light. On the third night several of the bats got into his hammock, and crawled over him; these were seized and dashed against the wall. In the morning he was unpleasantly reminded of the nocturnal visitation by finding that he had a wound on the hip, evidently caused by the bite of a bat. Being thereby roused to desperation, he set to work in real earnest to mitigate the nuisance. A large number were shot as they clung to the rafters, while the negroes ascended the roof from outside by means of ladders, and succeeded in routing out hundreds of them from beneath the eaves, among which were several broods of young ones. Although there were altogether four species of bats present on this occasion, one of which belonged to the genus *Phyllostoma*, another to *Glossophaga*, and two to the present genus, by far the greater majority pertained to the large-eared mastiff-bat (*M. perotis*), characterised by the great size of its ears, and having a span of wing of 2 feet. It was these bats which crawled over Mr. Bates while in his hammock; but it was the *Phyllostoma* (of which more anon) that appears to have inflicted the wound.

THE NAKED BAT.

Genus *Chiromelas*.

One of the ugliest and strangest of all the Chiroptera is the naked or collared bat (*Chiromelas torquatus*), of the Malayan region, which is a large species, measuring 5½ inches in length, exclusive of the tail. The total number of its teeth is 26, of which 1 are incisors, and ¾ are cheek-teeth on each side. With the exception of a collar of thinly-spread hairs, nearly surrounding the neck, the thick and puckered skin is almost completely naked. The great toe is longer than all the others, to which it can be opposed; the ears are not joined together, the lips are smooth, and the tail is very long and thick, with more than half its length freely projecting beyond the hinder border of the membrane between the legs.

The most curious feature about this repulsive-looking animal (in which, by the way, the muzzle is long and pig-like) is, however, the presence of a deep pouch on the under side of the body below the arm-pits. These pouches, which occur in both sexes, are for the purpose of containing the young during the period of suckling; and are absolutely necessary, since in their absence the young would be quite unable to cling to the naked body of the parent. Since these pouches are

present in the males as well as the females, Dr. Dobson suggests that in cases where there are twins the male parent may relieve his mate of the task of carrying one of the offspring; instances of a similar division of labour being believed to occur among the fruit-bats.

This bat, which is figured in the illustration on p. 246, occurs in the larger islands, such as Java, Sumatra, and Borneo, of the Malayan region, where it dwells in the heart of the densest forests. During the day its place of repose may be either a hollow tree, or a cleft in the rocks, or even a hole in the ground. Its flight, which is heavy and slow, commences as soon as the sun reaches the horizon, and takes place in the openings and glades of the forests, or even high up in the air in the open plains.



HEAD OF FEMALE OF THE NAKED BAT.—After Dobson.

THE WRINKLED-LIPPED BATS.

Genus *Nyctinomus*.

By far the most abundant in species of the bats of this group, as well as the most widely spread, are the wrinkled-lipped bats of the warmer regions. While closely allied to the mastiff-bats, they are distinguished by the upper incisor teeth being separated from one another in the middle line, and also by the much greater development of the vertical wrinkles on the capacious lips. The ears are generally more or less extensively united together at their bases, and the number of teeth varies from thirty-two to twenty-eight. One member of the genus, Ceston's bat (*Nyctinomus cestoni*), is the solitary representative of the whole family found in Europe, where it extends as far northwards as Switzerland. This species measures nearly $3\frac{1}{2}$ inches in length, exclusive of the tail, but most of the others are smaller. Ceston's bat has the peculiar power of being able to sink its eye within the socket, and then to protrude it again. It has, perhaps, the widest range of all the species, occurring not only in the south of Europe, but also in Egypt, Nubia, Amoy, and China. The late Mr. Swinhoe, writing of this species, observes: "I have often on a cloudless evening, at Amoy, seen these bats flying along, high in the air, being easily distinguished by the narrowness of their wings. When watched, the creature has a habit of exposing its tail, and of sinking its eye into the socket and thrusting it out again. The membrane extending from the tail to the legs is wrinkled, and covers the tail like a glove, so as to slip up and down as the creature wishes to expand or contract its interfemoral wing, or, in nautical language, to shake out or take in reefs." The tail cannot, however, be completely withdrawn into the membrane, in the manner of the tomb-bats.

Two species are found in India, two in Australia and New Guinea, and

four in America, but the majority are restricted to Africa south of the Sahara and Madagascar. The Indian species are generally found during the day in caverns and old buildings, countless myriads inhabiting the limestone caves of Phagat, 30 miles from Moulemein, in Burma. And it is probable that the habits of most of the other species are very similar.

Writing from Jamaica of the habits of the Brazilian wrinkled-lipped species (*N. brasiliensis*), Mr. W. Osburn observes: "Vast numbers of these little bats inhabit the shingled roof of my house. . . . I have often observed them during the day, exactly as Goldsmith's line expresses: 'lazy bats in drowsy clusters cling'; for, what seems surprising, notwithstanding the heat of the situation, shingles exposed to the sun (and it was disagreeably hot and confined where I stood, twelve or fifteen feet below), the bats clung in complete clusters. I counted fourteen little heads in a mass about the size of a turnip. But they are not all asleep; now and then a wing is stretched out with drowsy enjoyment; and the luxury King James thought too great for subjects, and which ought to be reserved for kings, is largely indulged in by these bats. First one and then another wakes up, and withdrawing one leg, and leaving himself suspended by the other alone, adroitly uses the foot at liberty as a comb, with a rapid effective movement dressing the fur of the under-parts and head—an action far from ungraceful. The foot is then cleaned quickly with the teeth or tongue, and restored to its first use. Then the other leg does duty. Perhaps the hairs with which the foot is set may aid to this end. I often have seen them do this in confinement, and probably the numerous bat-flies with which they are infested may be the cause of extra dressing."

THE NEW ZEALAND BAT.

Genus *Mystacops*.

That New Zealand, with its far more favourable climate for these animals than the British Isles, should possess only two species of bats is a very remarkable fact. One of these (*Chalinolobus tuberculatus*), belonging to a genus closely allied to *Vesperugo* (p. 273), is common to New Zealand and Australia: while the second is peculiar to the colony, and represents a distinct and aberrant group of the family under consideration.

The New Zealand bat (*Mystacops tuberculatus*) differs from the other members of the family *Emballonuridae* in that the third or middle finger of the wing is provided with three distinct bony joints: of which the first, when at rest, is folded back beneath, instead of above, its supporting metacarpal bone. Moreover, while the greater part of the wing-membranes is very thin, the portion along the sides of the body and the lower moieties of the limbs is much thickened: beneath this thickened portion the remaining parts of the wings lie folded away as if in a case; and in this condition this species is better adapted for a crawling or climbing life than any other member of the order. There are other peculiarities adapted to aid in climbing, connected with the thumb, feet, and legs. The length of the head and body is $2\frac{1}{2}$ inches; and the general colour of the upper-parts is brown, though beneath they are paler. Even the fur of this bat can, under the

microscope, be at once distinguished from that of all other species; the individual hairs being very thick, and with only faint traces of the projecting scales characteristic of other bats. The tail is extremely short. From its structural peculiarities Dr. Dobson is led to believe that this curious bat hunts for its insect food, not only in the air, but also on the branches and leaves of trees, among which it would certainly be able to creep with ease.

THE VAMPIRE-BATS.

Family *PHYLLOSTOMATIDÆ*.

The extensive group which it is convenient to allude to collectively under the name of vampires, is exclusively confined to Central and South America and the West Indian Islands. While related to the preceding family, with which they agree in the characteristics mentioned on p. 289, they differ in certain other points of importance. And they appear to have a relationship to the smooth-nosed free-tailed bats (*Emballonuride*) similar to that presented by the leaf-nosed bats (*Rhinolophide*) to the typical bats (*Vespertilionide*).

They are characterised by the presence of three bony joints in the third or middle finger of the wing, accompanied either by a well-developed nose-leaf, or by folds of skin and warts on the chin. Such of them as have a nose-leaf (and these are by far the great majority) may be always distinguished from the leaf-nosed and horseshoe-bats, not only by the number of joints in the third finger, and by the characters mentioned on p. 289, but likewise by the presence of a distinct tragus to the moderate-sized ears. Moreover, if we examine the dried skulls of any members of the two families, we shall find that while in the leaf-nosed bats and their allies the premaxillary bones, in which the one pair of small upper incisor teeth are implanted, are small, separate, and loosely attached to the skull, in the vampires these bones are large, firmly united both to one another and the skull, and generally carry two pairs of large incisor teeth.

The number of genera and species of vampires is so great that only the more remarkable types can be even mentioned in this work. With the exception of a few species having well-developed tails and a large membrane between the hind legs, which are of strictly insectivorous habits, the vampires are remarkable for the varied nature of their food: some subsisting on a mixed diet of insects and fruits, others being wholly frugivorous, and a few exclusively blood-suckers. Others again, although there has been, and still is, considerable doubt on the matter, appear to vary their ordinary diet by resorting to blood-sucking when occasion occurs. All are of purely aerial habits, and present none of the adaptations for crawling which characterise the mastiff-bats and their allies. They appear to be limited to the forest-clad districts of the regions they inhabit; and, according to Dr. Dobson, do not probably extend much farther south than the thirtieth parallel of latitude. That they are a highly specialised family is apparent both from their structure and the peculiar habits of many of their representatives. In South America the name vampire is applied indifferently to several members of the family—a circumstance which has been the fruitful source of confusion among European writers.

THE CHIN-LEAFED BATS.

Genera *Chilonycteris* and *Mormops*.

Two genera, the one containing six and the other two species, differ from the other members of this family in the absence of a nose-leaf, the function of which is performed by folds or lappets of skin depending from the chin. These bats may consequently be called chin-leafed bats. They are of small size, the largest only measuring $2\frac{1}{2}$ inches in length, exclusive of the tail. The two species belonging to the genus *Mormops* are distinguished from those included in the genus *Chilonycteris* by the great elevation of the crown of the head above the line of the face, as shown in our illustration. While most of the species are dull-coloured, Blainville's chin-leafed bat (*Mormops blainvillei*) is



HEAD OF BLAINVILLE'S CHIN-LEAFED BAT.
(From Dobson's *Catalogue of Bats in British Museum*.)

remarkable for the bright orange hue of its fur: and it is also remarkable for its extremely fragile structure, the head being so delicately formed that light can actually be seen through the roof of the open mouth.

THE HARMLESS VAMPIRES.

Genus *Vampirus*.

We take as our first example of those having a nose-leaf, the well-known great vampire (*Vampirus spectrum*). It belongs to a group of the family in which the tail, when present, perforates the membrane between the legs. The nose-leaf, as in most members of the family, is spear-shaped, whence the name of spear-nosed bats, frequently applied to all the vampires. The great vampire, according to Bates, is abundant in many parts of the Valley of the Amazon, such as the neighbourhood of Ega; and it is the largest of all the South American species, measuring 28 inches in expanse of wing. "Nothing in animal physiognomy can be more hideous than the countenance of this creature when viewed from the front,—the large leathery ears standing out from the sides and top of the head, the erect spear-shaped appendage on the tip of the nose, the grin, and the glistening black eye,—all combining to make up a figure that reminds one of some mocking imp of fable. No wonder that some imaginative people have inferred diabolical instincts on the part of so ugly an animal. The vampire is, however, the most harmless of all bats, and its inoffensive character is well known to residents on the Amazon. I found two distinct species of it, one having the fur of a blackish colour (*V. auritus*), the other of a ruddy hue (*V. spectrum*), and ascertained that both fed chiefly on fruits. The church at Ega was the headquarters of both kinds. I used to see them, as I sat at my door during the short evening twilights, trooping forth by scores from a large open window at the back of the altar, twittering cheerfully as they sped off to the borders of the forest. They sometimes enter houses. The

first time I saw one in my chamber, wheeling heavily round and round, I mistook it for a pigeon, thinking that a tame one had escaped from the premises of one of my neighbours. I opened the stomachs of several of these bats, and found them to contain a mass of pulp and seeds of fruits, mingled with a few remains of insects. The natives say they devour ripe cajus and guavas on trees in the gardens; but on comparing the seeds taken from their stomachs with those of all cultivated trees of Ega, I found they were unlike any of them. It is therefore



THE GREAT VAMPIRE-BAT ($\frac{1}{2}$ nat. size).

probable that they generally resort to the forest to feed, coming to the village in the morning to sleep, because they find it more secure from animals of prey than their natural abodes in the woods."

It will be observed that Mr. Bates speaks of the great vampire as *the vampire*, but, according to Dr. Dobson, this title is more properly applicable to the blood-sucking vampires noticed below. While the great vampire is entirely without a tail, the lesser vampire (*V. auritus*) has a small rudiment of that appendage. The latter species serves to connect the former with an allied genus of bats known as *Lophostoma*, in which the nose-leaf is narrower in front, and the chin has a central naked space marked by small warts. It also shows resemblances to the javelin-bats, mentioned on the next page, in the presence of a glandular opening near the top of the breast-bone.

THE JAVELIN-BATS.

Genus *Phyllostoma*.

Omitting mention of several allied genera, we come next to the javelin-bats, of which there are three species. These are distinguished from the harmless vampires by the much shorter and broader muzzle, and also by the presence of two (instead of three) premolar teeth on each side of the lower jaw.

The common javelin-bat (*Phyllostoma hastatum*) measures just under 4 inches in the length of head and body, and is next in point of size to the great vampire. Its general colour is usually dark-greyish, or reddish-brown above, and paler beneath, but sometimes the upper parts are of a brilliant chestnut-brown. The other two species are much smaller, measuring only 3 inches, or a fraction more, in length of head and body. All are found in Brazil, and they generally rest in the trunks of hollow trees, or beneath the leaves of palms. They have been accredited



THE JAVELIN VAMPIRE.

with blood-sucking propensities, and although Dr. Dobson seems disinclined to accept this view, yet the testimony of several observers inclines us to believe that the indictment is true. We have already alluded to Mr. Bates' account of his being wounded during the night by a bat which he refers to the present genus: and in the same passage he observes that "the fact of their sucking the blood of persons sleeping, from wounds which they make in the toes, is now well established: but it is only a few persons who are subject to this blood-letting. According to the natives, the *Phyllostoma* is the only kind which attacks man." The latter part of the statement makes this testimony the less convincing, since there is no doubt but that the blood-sucking vampires mentioned below are the species which most generally and habitually attack mammals. That the bat caught by Mr. Bates was a javelin-bat, or an allied form, is evident from his allusion to the large size of the nose-leaf; and thus the only way in which his statement could be disproved would be by assuming that, while a true blood-sucking vampire was the real culprit, the javelin-bat was the one caught and charged with the attack.

Mr. Wallace's testimony, as given in his *Travels on the Amazons*, is very similar to that of Mr. Bates; the javelin-bats being here also the ones charged with blood-sucking. In a later work (*Tropical Nature*), Mr. Wallace indeed speaks of the

bats charged with this crime as having their tongues armed at the tip with horny papillæ—which would seem to point to the under-mentioned long-tongued vampires, whose food is insects and fruit. He alludes, however, in both places to the blood-sucking bats as javelin-bats; and although there is evidently some confusion in regard to the tongue question, it is difficult to believe that two independent observers should have been so deceived as to charge members of one group of bats with an attack committed by those of another.

THE LONG-TONGUED VAMPIRES.

Genus *Glossophaga*, etc.

A group of several genera of rather small or medium-sized bats are at once distinguished from the other members of the present family by their long and narrow muzzles, and their slender, elongated tongues, which can be protruded for a considerable distance beyond the mouth. At their extremities these tongues are armed on the upper surface with a number of long, thread-like papillæ: and it was long considered that these papillæ were employed for abrading the skin of animals previous to the process of blood-sucking. It now appears, however, that their use is either to extract the soft pulp from the interior of hard-rinded fruits, or to lick out insects from the tubes of flowers. That some of the species feed on fruits has been ascertained by direct observation: but the discovery of the remains of insects in the stomachs of others proves that the diet of all is not of the same kind. One of the species which is known to feed on insects is the Soricine long-tongued vampire (*Glossophaga soricina*), and since this species has a well-developed membrane between the hind legs, while in some of those subsisting entirely on fruit the same membrane is very short, Dr. Dobson considers that we may predicate the nature of the food of any given species by the size of this membrane. The species with the longest tail-membrane will be the best flyers, and consequently those best suited for the capture of insects.

Writing of Sezekorn's long-tongued vampire (*Phyllonycteris sezekorni*), of which some individuals were taken from a large colony in a cave in Jamaica, Mr. Osburn describes their mode of feeding on the fruit of the so-called clammy cherry: "The tongue was rapidly protruded and drawn in again, and the juice and softer pulp cleared away with great rapidity. I noticed he was very particular in clearing out the bit of loose skin of berry, and licked my fingers clean of the juice spilt on them, carefully cleaning out any that had collected under the nail. I then got another berry. The bat was hanging against the edge of the box, its under-surface against the side; and as I held the berry a little distance off to see the action of the tongue, it had, whilst feeding, to bend the neck so as to raise the head a little; this seemed to fatigue it. It therefore raised itself on one wrist,



HEAD OF LONG-TONGUED VAMPIRE (*Phyllonycteris*),
(From Dobson.)

and turned round so that its back was against the box's side; but as it did not change the position of the feet, of course the legs crossed, the right foot now being on the left side, and *vice versa*. In this odd position it appeared perfectly at ease, and went on licking at a fresh berry with great relish. As the pulp and juice became exhausted I expected the bat would drop it, and was prepared with another berry; but, to my surprise, he brought up the wrists to the muzzle, took the berry between them, gave it two or three energetic bites, and then held the berry off. So I now understood what the unusually long thumbs were for; for they applied themselves dexterously to the berry, held it firmly, and then, as it appeared to me, by a reverse action of the two wrists the berry was turned round, a fresh hold taken by the teeth, and the same licking process renewed till the seed in the centre was cleaned of the pulp, all but the little bit which served for the last tooth-hold. It was then dropped, and the eager little muzzle raised for more."

THE SHORT-NOSED VAMPIRES.

Genus *Artibeus*, etc.

The short-nosed vampires comprise a group of nine genera, all the members of which are mainly of frugivorous habits. These bats may be easily recognised at sight by their very short and generally wide muzzles, furnished with a short nose-leaf, of which the front portion is horseshoe-shaped, and the hinder part spear-like. The membrane between the hind legs has its hinder margin excavated to form a hollow curve; and there is no trace of a tail. Two of the best known species are *Artibeus planirostris* and *A. perspallatus*, the former of which was regarded by



HEAD OF CENTURION BAT.
(From Dobson.)

Charles Waterton as the veritable blood-sucking vampire. The latter is abundant in the caves of Jamaica, and feeds on bread-nut, mangoes, and other fruit: it measures $3\frac{1}{2}$ inches in length, and, with its allies, may be considered in South America to take the place of the fruit-bats of the Old World. These bats fly early in the evening, and are in the habit of reposing during the day in places exposed to a considerable amount of light, having been observed beneath the eaves of a house in Demerara with the rays of the setting sun shining full on them. In

other places they have been found roosting in large clusters beneath the fronds of the cocoanut palm. Of another Jamaica species (*Stenoderma achradophilum*) Mr. P. H. Gosse remarks that it "feeds on the fruit of the naseberry. About a quarter of an hour after the sun has set, and while the sky is still glowing with effulgent clouds, these bats begin to fly round the tree. . . . On picking up a fruit you find that it has been just bitten and nibbled in a rugged manner. Fragments of naseberry of considerable size, partly eaten by a bat, are frequently found at the distance of half a mile from the nearest naseberry tree." The centurion bat (*Centurio senex*), of which the head is represented in the accompanying illustration, differs from all the members of this group by the absence of a distinct nose-leaf. Owing to the remarkable foldings of the skin, the face of this bat presents a most grotesque appearance.

THE BLOOD-SUCKING VAMPIRES.

Genera *Desmodus* and *Diphylla*.

The two species of blood-sucking vampires, each the solitary representative of a distinct genus, with which we close our account not only of the vampires, but also of bats generally, present the following distinctive characters:—

Firstly, they may be recognised by their very short and conical muzzles, surmounted by a small though distinct nose-leaf; as well as by the shortness of the membrane between the hind legs, and by the total absence of a tail. Secondly, they are characterised by the fewness and peculiar structure of their teeth; of which the total number is only twenty in one species, and twenty-four in the other. In the former there are no molar teeth, although a small rudimentary one is present on each side of the jaws of the latter. In the upper jaw there is a single pair of very broad-crowned incisors, which fill up the whole of the space between the tusks or canines, and have keen and sharp-cutting edges like chisels. The premolar teeth, of which there are two pairs in the upper and three in the lower jaw, have likewise trenchant cutting-edges working against one another, and being quite unlike those of any other bat. When we add to these characteristics the sharp tusks with which each jaw is provided, it will be evident that the teeth of the blood-sucking vampires must be specially adapted for some particular purpose—that purpose being blood-letting.

It is not by any means only in their teeth that these bats are adapted for their mode of sustenance, the structural modification also extending to their internal organs. Thus, whereas in other bats the stomach has the usual sub-globular form common to Mammals in general, in the blood-sucking vampires it becomes an elongated organ of a tube-like form: blood naturally requiring little or no process of digestion before being absorbed into the tissues of the animal by which it has been swallowed.

The common blood-sucking vampire (*Desmodus rufus*) is a comparatively small-sized bat, measuring only about 3 inches in length, and of a reddish-brown colour above, and usually some shade of yellowish-brown beneath. It has no true molar teeth, and likewise no spur on the ankle for the support of the membrane between the legs. The geographical range of this species is large, extending from Central America to Southern Brazil on the east of the continent, and to Chili on the west.

The smaller blood-sucking vampire (*Diphylla ecaudata*) serves to connect the common species with the other members of the family, having a small rudimentary upper molar tooth on each side of both jaws, and also a tiny spur on the ankle. It is further distinguished by the middle portion of the membrane between the hind-legs being quite undeveloped, as well as by certain features connected with the lower incisor teeth, which are peculiar in having distinct notches on the summits of their crowns. The colour of this bat is very similar to that of the common species; but the size of the animal is slightly less. This smaller vampire, which appears to be confined to Brazil, is stated to be far from common; and we have not met with any account of its having been caught in the act of blood-sucking, although there can be no doubt that this is its constant habit.

During the daytime these bats repose in caves or hollow trees, whence they issue forth for their nightly blood-sucking. It appears that when they have selected a victim for attack, they either settle down on or hover over the part to be operated on; and then proceed to shave away a thin portion of skin by a razor-like action of the sharp upper incisor teeth, by which the blood is caused to ooze from a number of the small capillary vessels, and is then sucked up by the mouth and swallowed. From their structure, it is probable that blood constitutes their whole diet.

The fact that certain bats in South America were veritable blood-suckers has been long known; our first information dating from a period soon after the conquest of that country. Great uncertainty prevailed, however, for a lengthened period as to which particular species of the large family of vampires were the real culprits; and the question was not finally decided till, during the voyage of the "Beagle," Mr. Darwin had the good fortune to see a *desmodus* caught in the very act. His account has been quoted over and over again, almost *ad nauseam*, and we shall refrain from repeating it here; merely mentioning that the bat in question—which was the common blood-sucking vampire—was caught by one of the great naturalist's servants actually sucking the blood from the withers of one of the camp horses. Thus was set at rest for ever the long vexed question as to which was the true blood-sucking vampire. It may be observed, however, that whereas it is now certain that the present group is the only one of which the members subsist entirely on a diet of blood, yet it is possible that, as already mentioned, some of the javelin-bats or their allies may, on occasions, vary their ordinary food with it.

FOSSIL BATS.

From the exigencies of space our account of the bats has been somewhat brief; but it may serve to show what an extensive assemblage of animals it really includes, and how different from one another in habits, as well as in details of structure, are many of its members, though all bats agree very closely in their general plan. This conformity to a common structural standard is as fully characteristic of the few fossil bats with which we are at present acquainted, as it is of their modern allies; the whole of them belonging to living families, and a large proportion to existing genera. At the comparatively early period when the Upper Eocene strata of the Paris basin were deposited, leaf-nosed bats, as well as typical bats nearly allied to the living noctule, had already come into existence, and have left their remains buried in the rocks alongside those of strange extinct hoofed mammals, such as the *Palæotheres* and *Anoplotheres*. And it is, therefore, manifest that if we ever succeed in discovering the ancestral forms from which bats have been derived, it will be in rocks of far greater age than those of the Paris basin, which belong to the lower portion of the Tertiary period of geological history. It is, indeed, within the bounds of probability that bats have existed as such from a period as remote as the one during which the English chalk was deposited on the floor of an ancient ocean.

CHAPTER XII.

THE INSECTIVORES,—Order INSECTIVORA.

THE absence of any vernacular name for that group of Mammals, of which the shrews, moles, and hedgehogs are the best known representatives, compels us to adopt an anglicised form of the Latin term by which the group is known; and we accordingly use the term *Insectivores* in this sense. This term, it is almost superfluous to add, refers to the insect-eating habits of most of the members of this order, and it is a good one, since, with the exception of the bats, there is no other group of Mammals which prey so exclusively on insects, or other small creatures.

Most of the *Insectivores* are comparatively small-sized animals; and, with the exception of the family of tree-shrews, and some of the aquatic forms, all are of more or less purely nocturnal habits. In the absence of any very strongly-marked characteristics, like the wings of the bats, the group is by no means easy of strict definition,—more especially when we have to avoid entering into the consideration of abstruse anatomical details.

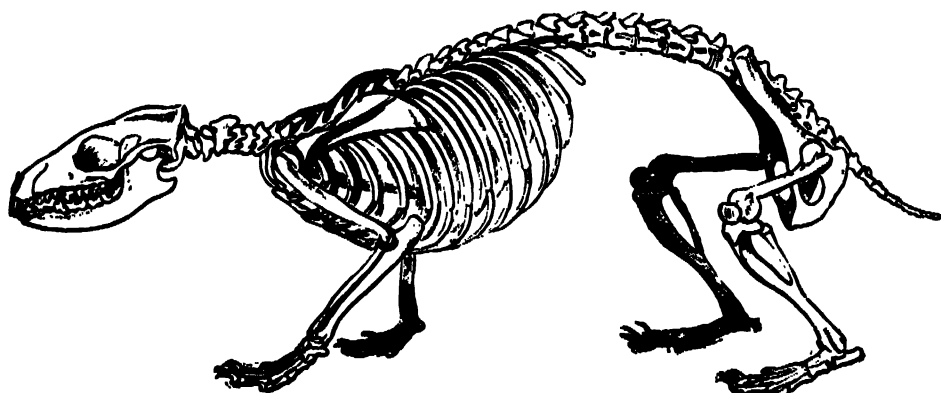
Characteristics. In addition to their generally small size and nocturnal habits, the *Insectivores* may immediately be recognised by the following structural features. All their toes are furnished with claws, and are in most cases five in number on each foot; while in no instance is either the thumb or the great toe capable of being opposed to the other digits. They walk either on the whole, or the greater portion, of the soles of their feet; and never on their toes only, in the manner of a cat or dog. Their upper molar teeth carry a number of small and sharp cusps, which are arranged either in a V-shaped or a W-shaped pattern; and their incisor teeth, of which there are not less than two pairs in the lower jaw, never assume the chisel-like form found in all the *Rodents* (rats, porcupines, hares, etc.); but the first or innermost pair is very frequently larger than either of the others, thereby distinguishing them from the *Carnivores*. In no instance is one pair of the cheek-teeth in each jaw ever modified so as to act with the scissor-like action characteristic of so many of the *Carnivores*. Then again the tusks, or canine teeth, are generally not markedly distinct from the other teeth,¹ so that it is frequently a matter of some difficulty—especially in the lower jaw—to decide which teeth are incisors, which tusks, and which premolars. This may be readily verified by comparing the skull of a hedgehog with that of a dog, in which the tusks cannot possibly be confused either with the incisors in front, or with the premolars behind.

If, again, we examine the skeleton of an *Insectivore*, it will be found that there are (with the single exception of one peculiar African species) always a pair

¹ This is not so in the common tenrec, which has large tusks.

of complete collar-bones, or clavicles, connecting the blade-bones (scapula) with the breast-bone, by which the order is at once distinguishable from the Carnivora. Externally, the Insectivores are very generally characterised by their very long and narrow snouts, in which the muzzle is produced considerably in advance of the end of the lower jaw; while their bodies are covered either with fur, or, more rarely, with a protecting armour of spines. On opening the skull it will be found that the upper surfaces of the lobes of the brain are smooth; and thereby very different from those of a Carnivore.

There are other distinctive characters of the order, for the proper appreciation of which a knowledge of anatomy is requisite. If, however, the whole of the points mentioned above receive due consideration, there will be but little fear of confusing an Insectivore with any other Mammal, except it be a Marsupial. The Marsupials, however, as will be shown in the sequel, are broadly distinguished by



SKELTON OF HEDGEHOG.

many important characteristics; while, were it not for the opossums, they would be restricted to the Australian region, in which Insectivores are unknown. Moreover, with the exception of the Virginian species, the opossums are confined to South America, where Insectivores are absent; and there is accordingly not much risk of a living Marsupial being mistaken for an Insectivore, or *vice versa*. In all respects, as is well shown by their small and smooth brains, the Insectivores occupy a very low position in the Mammalian series; and, next to the Marsupials and Monotremes of Australia, they may be regarded as more nearly allied to the original primitive Mammalian stock than any other members of the class now existing. Their nearest relatives are the bats, which, as already mentioned, may be regarded merely as Insectivores specially modified for a life in the air. It must not, however, be supposed that any living Insectivore can be regarded as the ancestral form of the bats: such ancestors having totally disappeared ages and ages ago. In other directions indicated by extinct types, it is probable that the Insectivores are allied to the lemurs on the one hand; while, on the other, they may have been derived from the Marsupials.

The Insectivores are widely scattered over the globe, although absent from the two large regions mentioned above. Some of the most curious forms are found in Madagascar, Africa, and the West Indian Islands.

The tendency being for low forms to disappear when brought into competition with higher types of animal life, it is interesting to observe that the Insectivores have either survived in islands, like Madagascar or Cuba, where the higher forms of Mammals are few or wanting, or, in the continental areas have acquired habits which serve to protect them from the attacks of foes. For instance, in addition to being strictly nocturnal, which is of itself a great protection, most of the Insectivores live in the depths of forests, or concealed among the stems and roots of coppices and shrubs, or in the deserted holes of other animals; while the moles have taken to a completely subterranean life, and the hedgehogs have acquired a special protection in their coat of thick-set spines. Others, again, like the water-shrews and the desmans, have resorted to the water, and hide themselves during their periods of repose in holes in the banks of rivers and lakes; while the diurnal tree-shrews seek the protection afforded by a life among the boughs of forest trees, after the manner of squirrels. Finally, the flying cobegos are peculiar in possessing the power of taking flying leaps from tree to tree, and are thus secure during their hours of movement from most enemies except man.

THE COBEGOS OR KAGUANS.

Family *GALEOPITHECIDÆ*.

Few Mammals have been a greater puzzle to zoologists, as regards their proper systematic position, than the cobegos, colugos, kulongs, or kaguans, of the Malayan region. These animals, of which there are two species, are known to the natives of the regions they inhabit by the names above mentioned, but they are commonly spoken of by Europeans either as flying lemurs or flying bats. They constitute the genus *Galeopithecus* of zoologists, which is the type of a distinct family: and as recent researches have shown that they come nearer to the Insectivores than to any other group, they are now generally regarded as constituting a special division of that order.

The most characteristic external feature of these curious animals is the parachute formed by folds of skin running along the sides of the neck and body, and connected with the long and slender limbs, of which the fingers and toes are webbed as far as the roots of their strong and curved claws. This parachute-like membrane is continued between the hind-legs to include the whole of the long tail, in which respect these animals differ from the flying squirrels to be mentioned hereafter. One of their most peculiar features is to be found in the structure of their lower front, or incisor teeth, which are quite unlike those of any other Mammal, or indeed of any animal. In both jaws these incisor teeth are expanded laterally, and compressed from front to back, with a number of cusps on their summits, and those of the lower jaw have very wide, flattened crowns, penetrated by a number of parallel vertical slits, so that they resemble small combs mounted upon narrow stems. Then, again, the outermost of the two pairs of upper incisor teeth, as well as the upper tusk, or canine (which is nearly similar to the incisors), are inserted in the jaws by two distinct roots. This is a unique feature among living Mammals, although the moles and hedgehogs have two roots to their upper tusks.

Habits. The common cobego is found in Sumatra, Borneo, Java, the Malay Peninsula, Tenasserim, and Siam, and is known as *Galeopithecus volans*. It is about the size of a cat; and its habits have been well described by Mr. Wallace, who met with it in Sumatra. He observes that the cobego "is sluggish in its motions, at least by day, going up a tree by short runs of a few feet, and then stopping a moment as if the action was difficult. It rests during the day clinging to the trunks of trees, where its olive or brown fur, mottled with irregular whitish spots and blotches, resembles closely the colour of mottled bark,



THE COBEGO ($\frac{1}{2}$ nat. size).

and no doubt helps to protect it. Once, in a bright twilight, I saw one of these animals run up a trunk in a rather open place, and then glide obliquely through the air to another tree, on which it alighted near its base, and immediately began to ascend. I paced the distance from the one tree to the other, and found it to be seventy yards; and the amount of descent I estimated at not more than thirty-five or forty feet, or less than one in five. This I think proves that the animal must have some power of guiding itself through the air, otherwise in so long a distance it would have little chance of alighting upon the trunk. The galeopithecus feeds chiefly on leaves, and possesses a very voluminous stomach and long convoluted intestines. The hair is very small; and the animal possesses such a remarkable

tenacity of life that it is exceedingly difficult to kill it by any ordinary means. The tail is prehensile, and is probably made use of as an additional support while feeding. The animal is said to have only a single young one at a time; and my own observation confirms this statement, for I once shot a female, with a very small, blind, and naked little creature clinging closely to its breast, which was quite bare and much wrinkled, reminding me of the young of the Marsupials, to which it seemed to form a transition. On the back, and extending over the limbs and membrane, the fur of these animals is short but exquisitely soft, resembling in its texture that of the chinchilla."

A very similar account is given of this species in Java by a much earlier writer, Horsfield, who states that, in addition to leaves, it feeds on the fruits of several trees when in an unripe condition, among these being young coconuts. In Java it is said to be "confined to particular districts, where it is met with chiefly on isolated hills, covered with a fertile soil, and abounding with young luxuriant trees, the branches of which afford it a safe concealment during the day. As the evening approaches, it leaves its retreat, and is seen in considerable numbers making oblique leaps from one tree to another; it also discovers itself by a croaking, harsh, disagreeable noise."

**Philippine
Cobego.**

Of the slightly smaller Philippine cobego (*G. philippinensis*), restricted to the islands from which it takes its name, we have a short account by Professor Moseley in his *Naturalist on the Challenger*. This observer relates how, when on Basilan Island—one of the Philippines—he was conducted by a native guide to a particular spot, for the purpose of shooting specimens of this animal. Here "some few trees were standing isolated, not having been as yet felled on the clearing. On one of these, after much search, a kaguan was seen hanging to the shady side of a tall trunk. It was an object very easily seen, much more so than I expected. It moved up the tree with a shambling, jerky gait, hitching itself up apparently by a series of short springs. It did not seem disposed to take a flying leap, so I shot it. It was a female with a young one clinging to the breast. It was in a tree at least forty yards distant from any other, and must have flown that length to reach it. I understood from my guide that numbers of these animals were caught when trees were cut down in clearing. They are especially abundant at the Island of Bojol, north of Mindanao; their skins were sold at Zebu, which lies near, at five dollars a dozen."

In their leaf-eating habits the cobegos stand apart from all other Insectivores, in this respect occupying the same relationship to the typical members of the order as is presented by the fruit-bats to the typical bats. Instead of possessing the power of true flight, characteristic of the bats, the cobego merely enjoys spurious flight, or the power of continuing the extension of an ordinary leap by the aid of its parachute.

It would require but comparatively little further modification to alter a cobego into a creature much resembling a bat, and endowed with the power of true flight; and we thus gain a good idea of the way in which the bats may have probably been derived from the Insectivores. It must not, however, be thereby supposed that the cobego is in any sense the missing link between these orders; its leaf-eating habits, as well as the peculiar structure of its incisor teeth, being alone amply sufficient to disprove its claim to that position;—the insect-eating

bats, which appear to be the ancestral groups of the order to which they belong, having in all probability been directly derived from insect-eating Insectivores. The cobeco should, indeed, be regarded rather as the sole representative of a side branch, which, while to some extent simulating the bats, never gave rise to any descendants showing the special modifications for true flight.

THE TREE-SHREWS, OR TUPAIAS.

Family *TUPAIIDÆ*.

With the tree-shrews, or tupaia, we come to the first family of the true Insectivores, or those which are incapable of flight, and have their front or incisor teeth of a normal form.

The tree-shrews, which are entirely confined to the Oriental region, take their name from their strictly arboreal habits; and are small, long-tailed animals, so closely resembling the smaller squirrels in external appearance as to be frequently mistaken for them. Indeed, it appears that the native term Tupai, from which these animals derive their second title, is applied indifferently by the Malays both to them and to squirrels; the affix Tana serving to denote the members of the present group. That they have really nothing to do with the squirrels is shown by an examination of their teeth, when it will be found that, instead of the single pair of chisel-like incisor teeth, they have two pairs of small incisors in the upper jaw, and three pairs in the lower.

Characteristics. The tree-shrews belong to a group of Insectivores characterised by their upper molar teeth, having broad crowns carrying a number of cusps, arranged in the form of the letter W. They are peculiar in that the socket of the eye, or orbit, is surrounded by a bony ring, whereas in other members of the order it is open behind. They are further distinguished from the other true Insectivores not only by their completely arboreal, but likewise by their diurnal, habits, as they feed entirely by day. They resemble squirrels in the general form of the body and limbs, and in possessing a more or less bushy tail. They have 38 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, and $\frac{1}{4}$ cheek-teeth, on either side of each jaw. Their feet, like those of squirrels, are naked beneath, with moderately curved and sharp claws. The muzzle is sharply pointed, the ears are small and rounded, and the long hair of the bushy tail is confined to its upper surface and sides, the under-surface having much shorter hair.

Distribution. Altogether, there are about thirteen species of the genus *Tupaia*, which have a wide distribution over the Oriental region. They are found in India, Burma, the Malay Peninsula, the Nicobar Islands, Sumatra, Java, Borneo, and the Philippines. They are very much alike in general appearance, the species differing mainly in respect of size and colour, as well as in the length of the fur. Many are restricted to particular islands; the Bornean tree-shrew, the Nicobar tree-shrew, and the recently discovered Philippine tree-shrew, being unknown out of the islands from which they take their names. Others, again, have even a still more restricted distribution: two species having hitherto been obtained only in the forests of Mount Dulit in North Borneo.

The largest member of the group is the Bornean tree-shrew (*Tupaia tana*). They may be found in clumps of trees as well as in forests; and, in addition to their resemblance to squirrels in appearance, they simulate those animals very closely in their movements, as they may not unfrequently be seen sitting upon their hind-quarters and holding their food in their fore-paws. Their food consists of insects and fruit; and although insects are usually sought on trees, tree-shrews may sometimes be seen hunting for food on the ground.

The Madras tree-shrew (*T. ellioti*), which is found in the forests of the greater part of Peninsular India to the southward of the plains of the Indus and Ganges, is a well-known species, of which the head and body measure from 7 to 8 inches in length, while the tail (including the hair) is about an inch longer. From the fact of several of this species having been met with by Prof. Ball lying dead in the jungle, it would seem that a fate similar to that which overtakes at



THE COMMON TREE-SHREW (A NAT. SIZE).

certain times of the year our common English shrew also befalls the tupaia. The Malay tree-shrew (*T. ferruginea*) is a rather smaller species, with a much wider distribution, extending from Assam and the Eastern Himalaya (where it is found at elevations of from three thousand to six thousand feet) to Burma and the Malayan Islands.

Habits.

Of the Malayan species, General M'Master writes, that it "is a harmless little animal, in the dry season living in trees, and in the monsoon entering our houses, and in impudent familiarity taking the place held in India by the common palm-squirrel; it is, however, probably from its rat-like head and thievish expression, very unpopular. I cannot," he adds, "endorse Jerdon's statement as to their extraordinary agility, for they did not appear to me to be nearly as active as squirrels; at least I remember one of my terriers on two

occasions catching one—a feat which I have never seen any dog do with a squirrel. Cats, of course, often pounce upon them.” Another observer, the Rev. Mr. Mason, remarks that “one that made his home in a mango tree, near my house at Tonghoo, made himself nearly as familiar as the cat. Sometimes I had to drive him off the bed, and he was very fond of putting his nose into the teacups immediately after breakfast, and acquired quite a taste both for tea and coffee. He lost his life at last by incontinently walking into a rat-trap.” The familiarity of this tree-shrew, and the ease with which it can be tamed, are mentioned by all who have written of its habits; and Dr. Cantor mentions that after feeding they are in the habit of dressing their fur and paws, after the manner of a cat, and that they are partial to water both as a bath and to drink. In disposition



1 TREE-SHREW ($\frac{1}{2}$ nat. size). (From Gray.)

they are described as being pugnacious in the extreme, fighting fiercely with one another when confined together in a cage, and in their wild state driving away all intruders of their own kind from their particular preserves. Their usual call is a short, peculiar, tremulous, whistling sound, but when roused to anger it is changed to shrill protracted cries.

The resemblance of the tree-shrews to the squirrels comes under the head of what is now termed “mimicry,” and may have been originally due to the extreme agility of the latter animals insuring them from pursuit by other creatures, as being a useless task. Hence it would clearly be an advantage for a slower animal to be mistaken for a squirrel. There is, however, a remarkable little

squirrel (*Sciurus tupaioides*) found in Sumatra and Borneo, which appears, for some reason or other, to simulate the tree-shrews, and thus to afford an instance of a kind of reversed mimicry. “Not only does this Rodent,” remarks Blyth, “resemble *T. ferruginea* in size, and the texture and colouring of its fur, but the muzzle is similarly elongated, and there is even the pale shoulder-streak usual in the genus *Tupaia*.”

Pen-tailed Tree-shrew.

In addition to the ordinary genera, the only other living member of the family is the pen-tailed tree-shrew (*Ptilocercus lowi*), which differs so remarkably in the structure of its tail as to form the solitary representative of a distinct genus. This little animal is between 5 and 6 inches in length, exclusive of the tail, which is of great length, and characterised by its upper two-thirds being naked, and the lower third ornamented with a double

fringe of long hairs, arranged like the barbs of a feather. The general colour of the fur is blackish-brown above, with the cheeks and lower-parts yellowish, and a dark streak running backwards from the muzzle to encircle the eye: while the tail is black, with most of the long hairs of the "pen" white. The first specimen known was captured by Mr. Low in the house of Sir James Brooke, at Sarawak; and the species was considered to be confined to that island. Of late it has, however, been discovered in some of the small islands in the neighbourhood of Borneo.

Fossil Tree-Shrews. As is the case with many of the Mammals of the Oriental region, the tree-shrews were represented in Europe during the middle of the Tertiary period by certain extinct genera. One of these (*Lanthanotherium*) appears to have been very nearly related to the living tree-shrews, while the other (*Galerix* or *Parasorex*) presents characters that connect it both with the tree-shrews and the jumping shrews.

THE JUMPING SHREWS.

Family *MACROSCELIDINÆ*.

As the tree-shrews simulate the squirrels in the Rodent order, so the jumping shrews approximate in form to the gerboas and gerbils. But while the resemblance in the former instance is a case of true mimicry, in the other it appears to be merely due to adaptation for a similar mode of life.

The jumping shrews, or, as they are sometimes called, in allusion to their prolonged snouts, elephant-shrews, are the African representatives of the tree-shrews, with which they agree in many points of their structure, although not in habits. They are exclusively confined to Africa; and while agreeing with the members of the preceding family in the relatively large size of their brains, as well as in certain other features of their internal anatomy, they are distinguished by structural differences entitling them to be regarded as the representatives of a separate family. Among these differences we may refer to the circumstance that the socket of the eye is not surrounded by a bony ring, but is open behind. Then, again, the metatarsus, or that portion of the foot immediately below the ankle-joint, instead of being of the normal proportions, is greatly elongated, so as to make the whole foot nearly as long as the lower leg. Further, instead of pursuing an arboreal and diurnal life, like the tree-shrews, the jumping shrews restrict themselves to the ground, upon which they progress by leaps, and are mainly or entirely nocturnal.

Typical Forms. The typical jumping shrews, constituting the genus *Macroscelides*, of which a species (*M. typicus*) is represented in the illustration on the following page, are characterised by the number of their teeth and toes. With one exception, these animals have 42 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, and $\frac{1}{4}$ cheek-teeth on either side of the jaws. Invariably they possess five toes on the fore-feet; while, with the single exception above mentioned, where there are but four, the same number obtains in the hind-foot. Their ears are large, and the tail naked and rat-like.

Distribution. Numerous species of this genus are found over a large part of the African continent, their range extending from the Cape to Algiers; and most of them being very much alike, both as regards size, form, and colour. The species figured here is the Cape jumping shrew, a tawny-brown animal of about 5 inches in length, exclusive of the tail; the length of the latter being about 3 inches. They are very common in South Africa, where they dwell among grass and bushes, coming forth at dusk from their hiding-places to scour the plains in search of their insect food. The Algerian jumping shrew (*M. rozeti*) is a very similar animal, known to the French colonists of the districts it inhabits as the *rat à trompe*, which is said to vary the insect diet of the Cape species with



CAPE JUMPING SHREW ($\frac{1}{2}$ nat. size).

an admixture of vegetable food. Like the tree-shrews, this species can be readily tamed, and soon becomes familiar, not to say impudent.

Rock Jumping Shrew. Of larger size than any of the other species of the genus, is the rock jumping shrew (*M. tetradactylus*), of the Mozambique coast of East Africa, which derives its name from dwelling in rocky districts, where it conceals itself in the crannies and clefts of rocks. The most important characteristic of this species is, however, the presence of only four toes to the hind-feet, the small inner toes found in the other species having disappeared. It is likewise peculiar in having but forty teeth, owing to the loss of the last molar on either side of the lower jaw.

Long-nosed Jumping Shrew. More remarkable than any of the above are the long-nosed jumping shrews, of which there are four species from Zanzibar and the adjacent regions of the East Coast of Africa. These collectively constitute the genus *Rhynchocyon*, distinguished from the preceding group by having only thirty-six teeth, and but four toes on both fore- and hind-feet. Further, the hind-

limbs are relatively shorter than in the typical jumping shrews, while the muzzle is so much produced as to form a veritable trunk. The reduction in the number of the teeth is due to the disappearance of two out of the three pairs of incisors in the upper jaws: and in very aged individuals even the single remaining pair may be shed, thus leaving the creature without any upper front teeth. The length of the head and body of the best-known species is about 8 inches; and that of its long, scaly, rat-like tail somewhat less. Its general colour is rusty-brown, becoming blacker on the top of the head and along the back; while the flanks have some bright reddish spots just below the hinder part of the back.



ROCK JUMPING SHREW ($\frac{1}{2}$ nat. size). (From a Plate by Peters.)

Habits. From the reduction in the number of their teeth and toes, as well as from the prolongation of the muzzle, we may regard the long-nosed jumping shrews as very specialised creatures. Unfortunately, we know little or nothing of their habits; but from their relatively shorter hind-legs it may be assumed that they are less habitual leapers than the typical members of the family. Like many of the more aberrant Insectivores, the long-nosed jumping shrews appear to be very rare animals.

THE HEDGEHOGS AND GYMNURAS.

Family *ERINACEIDÆ*.

The hedgehogs and their near allies the gymnuras constitute a well-marked family, distinguished by several important characters from the preceding groups. The more important of these characteristics are, however, of such a nature as to be but briefly referred to in this place. It may be observed, however, that the brain (as may be readily seen from the dimensions of its chamber in the dried skull) is relatively smaller, and the union of the anterior elements of the pelvis in the middle line on the inferior aspect of the body shorter than in the preceding families. Further, if the cavity for the eye in the dried skull be examined, it will be found that there is not even a trace of any bony process to mark off its hinder limit from the larger hollow containing the muscles that work the lower jaw. With the exception of one species, all the members of the family have five-toed feet, provided with simple claws not adapted for digging; this feature being

in accordance with their purely terrestrial and non-fossorial habits. And the broad first and second molar teeth of the upper jaw are characterised by having five distinct cusps, of which the central one is very small, and connected with the two inner ones by a pair of oblique ridges.

THE HEDGEHOGS.

Genus *Erinaceus*.

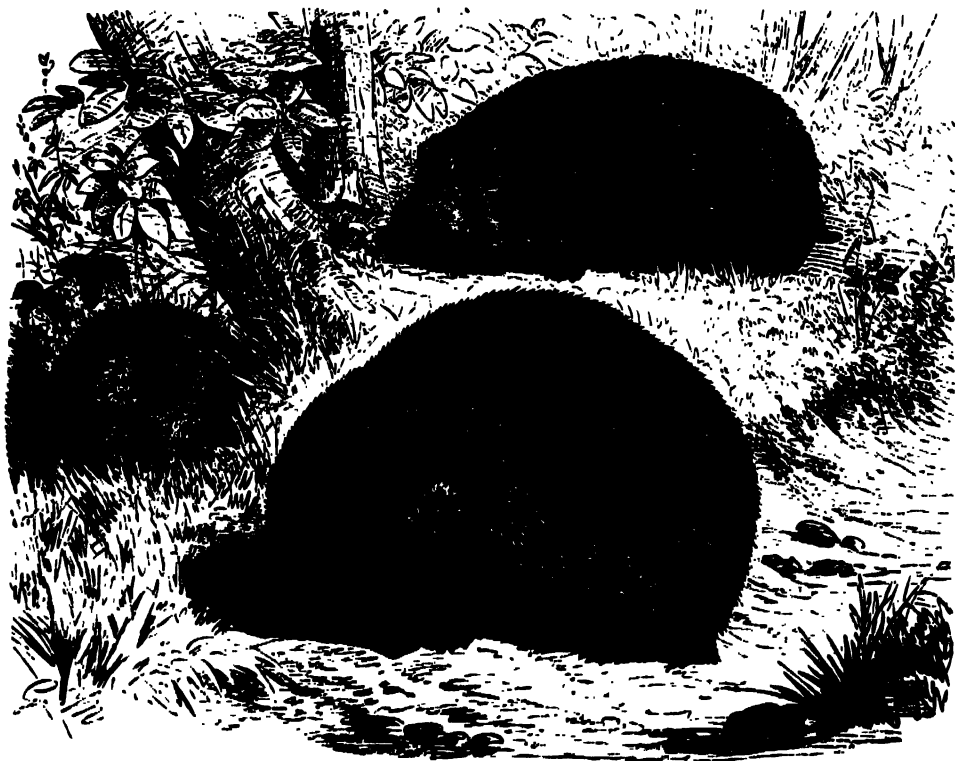
The European hedgehog, or urchin, which is far the largest of the British Insectivores, is the best known representative of a somewhat extensive genus distributed over the greater portion of Europe, and parts of Africa and Asia, although unknown in Madagascar, the Malayan Peninsula and Islands, Burma, Siam, Southern China, and Siam.

The essential characteristics of the hedgehogs, as distinct from the gymnuras, are to be found in the dense coat of short spines covering the back and sides of the body, and also the shortness of the tail. The hedgehogs have 36 teeth, of which, on each side, $\frac{3}{2}$ are incisors, $\frac{1}{2}$ canines, and $\frac{5}{2}$ cheek-teeth. An examination of the skull will show that the first pair of front or incisor teeth in the upper jaw have remarkably long crowns, which are widely separated from one another in the middle line; while the two remaining incisor teeth on each side of the same jaw are much smaller. It will further be observed that the middle region of the palate of the skull contains some open spaces not occupied by bone. The common hedgehog (*Erinaceus europæus*) is characterised by the short and almost imperceptible neck, the pig-like snout, from which it derives its popular name, and also by the shortness of its limbs. Exclusive of the short naked tail, which measures about $1\frac{1}{2}$ inches, an average-sized hedgehog is about 10 inches in length. The great peculiarity of all the hedgehogs is the power they possess of rolling themselves up into a ball-like form, presenting a *chevaux-de-frise* of spikes, impenetrable to the great majority of other animals. This rolling-up process is effected by the aid of an extraordinary development of a layer of muscles found beneath the skin of most Mammals, and known as the *poniculus carnosus*. When rolled up, the head and feet are tucked inwards, so that only the spines are exposed; and it requires a bold dog or fox to attack a hedgehog when in this condition. Under the microscope the spine is seen to be marked by a number of parallel longitudinal grooves; the ridges between them being ornamented, in some of the foreign species, with rows of tubercles. Hedgehogs date from a remote antiquity; and it is doubtless solely due to this protective armour of spines that animals of such low organisation and of such comparatively large size have been enabled to survive without resorting to the protection afforded by a subterranean or aquatic mode of life.

Habits.

The food of the European hedgehog is very varied, including insects, worms, slugs, snails, lizards, snakes, birds' eggs, rats, mice, and other small animals; while roots and fruit are also consumed to a certain extent. The partiality of hedgehogs for insects is often taken advantage of in ridding houses of beetles and cockroaches; although the hedgehog itself not unfrequently

comes to an untimely end by a too close approach to the kitchen stove for the sake of warmth. A hedgehog kills a snake by inflicting a series of bites, and quickly assuming the defensive when threatened with attack. That eggs are largely consumed by these animals is proved by the readiness with which they are caught in traps thus baited. On account of such depredations, as well as from their destructiveness to young birds, they are much persecuted by gamekeepers. There is, moreover, at least one instance on record of a hedgehog having attacked a young leveret, which it would doubtless have despatched had it not been interrupted. Hedgehogs venture forth from their hiding-places in hedges, coppices, or



THE COMMON HEDGEHOG (A nat. size).

shrubberies during summer, as soon as the dews of evening commence, and may be detected devouring worms or other prey on moonlight nights. A worm is eaten slowly by being seized by one extremity, and turned from side to side of the mouth, while it is being chewed by the sharp cheek-teeth; much the same process taking place in the case of a snake.

Although properly nocturnal in their habits, they may occasionally be met with searching for food during the day: and it has been suggested that on such occasions they are driven to depart from their ordinary habits by the necessity of procuring a sufficient supply of food for their young, which are usually produced during the months of July and August, and are said not to exceed four in a litter, although it was formerly considered that the number might be as

many as eight. Occasionally a second litter is produced during the autumn; and it is believed that the period of gestation is not longer than a month. The new-born young are almost naked, and their imperfect spines are soft, flexible, and white, although rapidly hardening in the course of a few days. They are at first totally blind, and quite incapable of rolling themselves up. The nest in which the young are born is carefully constructed, and is said to be always protected from rain by an efficient roof. In winter the European hedgehog hibernates completely, laying up no store of food, but retiring to a nest of moss and leaves, where, rolled up in a ball, it lies torpid till awakened by the returning warmth of spring. As



HEDGEHOG AND YOUNG.

a rule, hedgehogs are comparatively silent creatures, but on occasions they give vent to a sound said to be something between a grunt and a low piping squeak.

Distribution.

The range of the hedgehog in Britain includes the whole of England and portions of Ireland, but does not extend beyond the middle of Scotland: its presence in the Shetland Islands being probably due to human introduction. Eastwards it extends to Eastern China and Amurland, and it also embraces the region from the sixty-third parallel of latitude in the Scandinavian Peninsula, to Southern Italy, Asia Minor, and Syria. Not only is the European hedgehog found in the lowlands of the regions over which it extends, but in the Alps it ascends to an elevation of six thousand feet, and in the Caucasus to upwards of eight thousand feet above the sea-level.

Altogether there are nearly twenty known species of hedgehogs, and among these the European form is in some respects quite peculiar. Its fur mingled with the spines is very coarse and harsh, and the upper tusk, or canine tooth (the fourth tooth from the extremity of the muzzle), is inserted by a single root,

while in all the others the fur is softer and finer, and the upper canine tooth has two roots, and closely resembles the cheek-teeth.

Hedgehogs are represented by five distinct species in India, all characterised by having minute tubercles on the ridges of their spines. It is remarkable that while one of these hedgehogs (*E. micropus*) is found in Madras, no representative of the genus is recorded from the Central Provinces and Bengal, the other species not occurring till we reach the North-West Provinces, the Punjab, etc. But little is known of the habits of these Indian species, and nothing as to their breeding: although it is probable that in both these respects they conform closely to their European cousin. The long-eared Afghan hedgehog (*E. megalotis*), common in the neighbourhood of Kandahar and Quetta, hibernates, but the species from the Punjab and Southern India are active at all seasons of the year, thus showing how absolutely dependent is the habit of hibernation upon climate. The collared hedgehog (*E. collaris*), found in the plains of North-Western India, inhabits "sandy country, hiding in holes beneath thorny bushes or in tufts of grass during the day, feeding chiefly on insects, especially a species of *Blaps*, and also on lizards and snails. It makes a grunting noise when irritated, and when touched suddenly jerks up its back so as to throw its spines forward, making at the same time a sound like a puff from a pair of bellows." Mr. Blanford just quoted, also states that the Afghan hedgehog feeds on the slugs and snails so common in the fields round Kandahar, as well as worms, insects, and lizards. It hides during the day in holes: and hibernates from the end of October or beginning of November till February.

African Species.

If we know but little of the habits of the Asiatic hedgehogs, this lack of information is still more marked with respect to those of Africa, where some species are found in the Cape district, and others in the regions to the north of the Sahara (*E. algirus*), and in Egypt, as well as on the West Coast. One of these (*E. albiventris*) is peculiar in having lost the inner toe of the hind foot: although its claw has been found on one foot of an adult female from Lagos, as well as on both feet of young specimens from the same locality.

Extinct Species.

Fossil hedgehogs are met with in the Tertiary rocks of Europe as far back as the early portion of the Miocene period. Some of the extinct hedgehogs belonged to the existing genus *Erinaceus*; and one of them (*E. aenigensis*), from the middle Tertiary fresh-water limestones of Baden, appears to be allied to the Algerian hedgehog, being totally different in the structure of its teeth from the common European species. Others are, however, distinguished by having a complete bony roof to the palate, and these form a distinct genus, which may be allied in this respect to the gymnuras.

THE GYMNURAS.

Genus *Gymnura*.

The gymnuras, which are not unlike large rough-haired shrews, take the place of the hedgehogs in Burma and the Malayan region. Although closely allied to the hedgehogs in the structure of their teeth and other details of their anatomy,

these Insectivores are so unlike them in external appearance that it is difficult to believe in their close affinity. It must be remembered, however, that the spines of the hedgehogs totally alter the appearance of the creature from what it would be, if unprovided with these appendages; and if we were to compare a gymnura with a young hedgehog, in which the spines were still rudimentary, the difference in appearance would not be so very marked.

Characteristics. The gymnuras are distinguished from the hedgehogs by the total absence of spines; and also by the long naked tail, from which they derive their name. Further points of distinction are afforded by the complete bony roof to the palate, and also by the larger number of teeth in the gymnuras,

which is upwards of forty-four. The large and typical number of teeth characteristic of these animals is, indeed, but very rarely met with among existing Mammals, although it was common amongst extinct forms. In this respect, therefore, the gymnura betrays the antiquity of the group to which it belongs.



RAFFLES'S GYMNURA.

Raffles's gymnura (*Gymnura rafflesi*)—so named after Sir

Stamford Raffles—is an animal somewhat resembling a large rat with a long pointed nose; the length of the head and body varying from 12 to 14 inches, and that of the long rat-like tail from $8\frac{1}{2}$ to $9\frac{1}{2}$ inches. The head and body are generally parti-coloured, with considerable individual variation in the distribution of the black and white. Usually, however, the greater part of the head and neck is white; but there is a black patch in front of and another above each of the eyes, and there are frequently some long black hairs on the crown of the head. The terminal third of the tail is generally white. Occasionally specimens are found in Burma of a uniform white colour throughout; these, however, must not be regarded as albinos. The hair is of two kinds—a close, soft under-fur and long coarse bristles.

Distribution. Raffles's gymnura is found in the islands of Sumatra and Borneo, in the Malay Peninsula, and in Burma. It is either a rare animal, or on account of its retiring and strictly nocturnal mode of life is but seldom met with. Of its habits we are still ignorant. It is, however, said to make its home beneath the roots of trees; and, from the contents of the stomachs of specimens that have been examined, we learn that its food consists of different kinds of insects; cockroaches, white ants, and larvæ being apparently its favourites. It is distinguished by a peculiarly disagreeable smell of a somewhat oniony or garlic-like nature.

Still more rare is the lesser gymnura (*G. suilla*), a small rusty-brown coloured animal, paler beneath, measuring just short of 5 inches in length, with a tail not exceeding an inch. It occurs in Burma, the Malay Peninsula, Sumatra, Borneo, and Java, ascending in Borneo to a considerable elevation above the sea-level on Mount Kina Balu in the northern part of the island.

Extinct Gymnuras. Extinct Insectivores, more or less closely allied to the gymnuras, have left their remains in the Tertiary deposits of France belonging to the upper portion of the Eocene and the lower part of the Miocene period. These extinct forms, although belonging to distinct genera from those now existing, serve to show the antiquity of this group of animals; and, in common with many others, further indicate how the early Tertiary fauna of Europe has its nearest representatives in the remote islands of the Malayan Archipelago.

THE SHREWS.

Family *Soricidae*.

The elegant little creatures known as shrews, or shrew-mice as they are often termed from their mouse-like form, constitute the fourth family of the true Insectivores. So like, indeed, are these animals to mice and rats, that in popular estimation they are often confounded with them; although they are readily distinguishable by their long and pointed snouts, their rounded ears, closely pressed to the sides of the head, and the characters of their teeth.

Though there would be little likelihood of mistaking a shrew for a hedgehog, it is necessary to point out in some detail the characters on which naturalists refer these groups to separate families: since, as we have seen, the spines of the hedgehogs do not form a characteristic of more than generic importance.

Perhaps the most ready means of determining whether or no an Insectivore belongs to the shrew family is afforded by the characters of the first pair of front or incisor teeth. In all shrews these teeth are different from the others; those of the upper jaw (as shown in the figure) being long and generally sickle-shaped, with a more or less distinct cusp at the base of their hinder border; while in the lower jaw they are long and project horizontally forwards, sometimes curving upwards at the tips. Moreover, with the single exception of one peculiar African species, which has a rudimental seventh tooth, the lower jaw of every shrew has only six teeth on each side.

The above features are sufficient to distinguish a shrew from any other Insectivore; but a few additional characteristics may also be mentioned. Thus the first and second upper molar teeth of all the shrews differ from those of the hedgehogs and gymnuras by the absence of the fifth or central cusp on the crown. Then, again, the skull of a hedgehog or gymnura, as shown in the figure of the skeleton of the former given on p. 308, has a complete bony bar—the zygomatic arch—running below the socket for the eye to connect the upper jaw with the hinder part of the skull. In a shrew, on the other hand, this bony arch, as shown in the accompanying figure, is invariably incomplete beneath the eye, owing to the absence of the cheek-bone.¹ A further characteristic feature of the shrews is the extreme length and narrowness of their skulls.



SIDE VIEW OF THE RIGHT ANTERIOR UPPER TEETH OF THE SWIMMING SHREW FROM UNALASKA ISLAND.

Much enlarged. The first upper incisor (the tooth on the right of the figure) is less sickle-shaped than usual.—After Dobson.

¹ In one Indian hedgehog the zygomatic arch is incomplete.

With the exception of a few species which have taken to an aquatic life, the shrews are terrestrial and nocturnal in their habits. They are all covered with fur, generally remarkable for its softness: the head is long, with a sharply pointed snout projecting far in advance of the tip of the lower jaw; their eyes are extremely small and bead-like; and the external ears, if present at all, are rounded, and not unlike the human ear in general contour.

Distribution and Habits. The shrews have a more extensive distribution than any other family of Insectivores, and likewise comprise a far larger number of species. They are to be met with throughout the whole of the temperate and tropical regions of Europe, Asia, Africa, and North America, as well as on many of the adjacent islands: one species extending as far north as Unalaska Island in the Aleutian group. "From their obscure and retiring habits," writes Bell, "the shrews are difficult of observation: their long and pointed snout, their extensible form, and short and velvety coat enable them to pass through the closest herbage, or beneath the carpets of dry leaves in the coppice and woodland, in which situations, as well as in the open fields, whether cultivated or in pasture, they seek their



SKELTON OF WATER-SHREW.

food. But they are not confined in their habitat to such situations, as with their congeners, the water shrews, they are often met with in marshy and fen districts." On the other hand, one of the Indian shrews constantly frequents dwelling-houses. The number of genera (to say nothing of species) of shrews is so considerable, that it is only possible to notice here some of the more interesting and important. The genera may be arranged under two groups, according as to whether the teeth are stained of a reddish-brown colour or are of the ordinary white hue.

THE TYPICAL SHREWS.

Genus *Sorex*.

In addition to their red teeth, the typical shrews, as represented by the common European shrew (*Sorex vulgaris*), figured on the right side of the following illustration, are characterised by the number of their teeth being thirty-two, and by the large size of their ears and the length of the tail: the latter being covered with hairs of nearly, or quite, uniform length. With the exception of two peculiar species, all these shrews are terrestrial: and they inhabit Europe, Asia north of the Himalaya, and North America. And it may be remarked here that the red-

toothed shrews are quite unknown in Africa south of the Sahara, and they are only represented in India and the rest of the Oriental region by a single small genus (*Soriculus*).

Common Shrew. The common shrew, found abundantly in the British Islands, measures just short of 3 inches in length, exclusive of the tail, and is usually of a reddish mouse-colour above, paler beneath, with the tail somewhat quadrangular and rather shorter than the body. There is, however, considerable individual variation in colour, specimens being sometimes found banded with white.

Habits. Like the mole, the common shrew has a wide geographical range, extending from England, through Europe and Asia to North America. The facility with which this species conceals itself has been already mentioned. Its



THE SPIDER MUSK-SHREW AND COMMON SHREW (nat. size).

food is chiefly insects and worms, supplemented by snails and slugs. In disposition it is so pugnacious that two are rarely seen together except when engaged in combat; and if two or more are confined together, it is not long before the stronger kills the less robust. The strong scent with which the shrew is provided probably acts as a preventive against the attacks of some of its foes, but it is now ascertained that this is not sufficiently repulsive to deter owls from killing and devouring shrews. It was long considered that the numbers of dead shrews to be found in most gardens during the autumn were due to the attacks of cats, which are known to kill, although they will not eat these animals. Dr. Dobson considers, however, that the real cause of death is rather to be attributed to insufficiency of their proper food at that season of the year; and this interpretation is supported by the consideration that it would be otherwise difficult to account for the mortality being confined to one period of the year. Shrews hibernate in Europe throughout the winter, and during the spring and summer produce their litters of blind and

toothless young; the number in each litter being usually five, six, or seven, but occasionally more.

Lesser Shrew. In Ireland the place of the common shrew is taken by the lesser shrew (*S. pygmaeus*), which, although also found in England, is there much more rare. It may be distinguished by its inferior size, and also by the circumstance that the third tooth from the extremity of the upper jaw (the third incisor) is not longer than the fourth. Like its larger cousin, this species has an extensive range in Europe and Asia north of the Himalaya, but does not extend across Behring Strait into America.

Alpine Shrew. In marked contrast to the wide range of these species is the restricted distribution of the Alpine shrew (*S. alpinus*), a species of rather larger size than the common shrew, and distinguished by the uniform coloration of the upper and under surfaces of the body. This shrew is only found in the mountains of Central Europe.

North American Shrews. A variation in size comparable to that existing among the European members of the genus is likewise found in its North American representatives, among which Bendire's shrew (*S. bendirei*) is the largest, and Cooper's shrew (*S. cooperi*) the smallest form. Of the latter Dr. Hart Merriam writes that "although underground life does not appear to be as attractive to it as to its relatives the moles, yet it avoids too much exposure, and commonly moves, by night and by day, under cover of the fallen leaves, twigs, and other debris that always cover the ground in our northern forests. The naturalist well knows that, however cautiously he may walk, the stir of his footsteps puts to flight many forms of life that will reappear as soon as quiet is restored; therefore, in his excursions through the woods, he waits and watches, frequently stopping to listen and observe. While thus occupied, it sometimes happens that a slight rustling reaches his ear. There is no wind, but the eye rests upon a fallen leaf that seems to move. Presently another stirs, and perhaps a third turns completely over. Then something evanescent, like the shadow of an embryonic mouse, appears and vanishes before the eye can catch its perfect image. Anon the restless phantom flits across an open space, leaving no trace behind. But a charge of fine shot dropped with quick aim upon the next leaf that moves will usually solve the mystery. The author of the perplexing commotion is found to be a curious sharp-nosed creature, no bigger than one's little finger, and weighing hardly more than half a drachm. Its ceaseless activity, and the rapidity with which it darts from place to place, are truly astonishing, and rarely permit the observer a correct impression of its form. Whenever a tree or a large limb falls to the ground these shrews soon find it, examining every part with great care, and if a knot-hole or crevice is detected, leading to a cavity within, they are pretty sure to enter, carry in materials for a nest, and take formal possession. . . Not only are these agile and restless little shrews voracious and almost insatiable, consuming incredible quantities of raw meat and insects with great eagerness, but they are veritable cannibals withal, and will even slay and devour their own kind."

The marsh-shrew (*S. palustris*) from the Rocky Mountains, together with the swimming shrew (*S. hydrodromus*) from one of the Aleutian Islands, differ from the other members of the genus in having their feet provided with fringes of long hair to aid them in their aquatic life.

THE SHORT-TAILED OR EARLESS SHREWS.

Genus *Blarina*.

With the exception of the water-shrews, the only other members of the red-toothed section of the family to which we shall allude are the so-called short-tailed and earless shrews, of North and Central America. These shrews are readily distinguished by their short tails and the truncation of the upper part of their ears; some of them having the same number of teeth as the typical shrews, while in others the number is reduced to thirty. The variation in the size of the different species of this genus is nearly as marked as in the preceding one.

The common short-tailed shrew (*Blarina brevicauda*) occurs in the Adirondack Mountains, near New York, and is remarkable for remaining active during the whole of the rigorous winters of these regions, having been observed running about on the snow when the thermometer indicated 20 below zero. This peculiar habit is correlated with equally marked peculiarities in the diet of this species, which frequents both the dense pine forests of the uncultivated districts, and the cleared tracts of the inhabited regions. This shrew, writes Dr. Merriam, "seeks its food both by day and night: and, although the greater part of its life is doubtless spent under ground, or at least under logs and leaves, and amongst the roots of trees and stumps, it occasionally makes excursions upon the surface, and I have met and secured many specimens in broad daylight. It subsists upon beech-nuts, insects, earthworms, slugs, sow-bugs, and mice, and can in no way be considered other than as a friend to the farmer."

THE WATER-SHREW.

Genus *Crossomys*.

The water-shrew (*Crossomys fulvus*) is the sole representative of a genus agreeing with some of the short-tailed shrews in possessing thirty teeth, but distinguished by the small ears not being truncated, by the long tail, and also by the fringes of long hair on the under surface of the latter and on the feet. This shrew, as its name implies, is of thoroughly aquatic habits; the fringes of stiff hair on the tail and limbs being designed to afford aid in swimming. In length it measures about $3\frac{1}{2}$ inches, exclusive of the long tail. Owing to the circumstances, that while in most cases the under-parts of the body are white, while in others they partake more or less completely of the black hue of the back, it was formerly considered that there were two distinct species of water-shrews, although subsequent observations have shown that such variations are merely individual.

Habits.

The water-shrew, although unknown in Ireland, is commonly, but locally, distributed over England and the south of Scotland. It likewise occurs over a large area of continental Europe, from whence it extends eastwards into Asia as far as the Atlas range. In the water these graceful little creatures are as much at home as water-voles or beavers; and in clear streams they may not unfrequently be observed during the day diving or running along the

bottom, and turning over the pebbles with their sharp noses in search of fresh-water shrimps, which appear to constitute their favourite food. In addition to these crustaceans, the water-shrew devours many kinds of aquatic insects or their larvæ, while it is also probable that it likewise preys on the spawn or fry of minnows and other small fish. There are, moreover, several instances on record where water-shrews have been found feeding on the flesh of larger animals, which they have found dead. The swimming of the water-shrew, writes Prof. T. Bell, seems to be "principally effected by the alternate action of the hinder feet, which produces an unequal or wriggling motion; it makes its way, however, with great velocity, and as it swims rather superficially, with the belly flattened, the sides, as it were, spread out, and the tail extended backwards as a rudder, it forms a very beautiful and



THE WATER-SHREW (nat. size.)

pleasing object, moving on the calm surface of a quiet brook, or diving, in an instant, after its food, its black velvety coat becoming beautifully silvered with the innumerable bubbles of air that cover it when submerged; and on rising again the fur is observed to be perfectly dry, repelling the water as completely as the feathers of a water-fowl. When submerged, the ear is nearly closed by means of three little valves." The burrows of the water-shrew are constructed in the banks of the pond or stream in which it dwells; and, if disturbed from the protection thus afforded, the creature plunges forthwith into the water to seek safety in what must be regarded as its native element. The female gives birth to the young in the burrow, the usual number produced at a litter varying from five to seven or eight.

In addition to its darker coloration, and the structural differences already mentioned, the water-shrew may be distinguished at a glance from the common shrew by its stouter and somewhat depressed muzzle. The red stain on the teeth

is, moreover, much less decided than in the latter; and indeed, when the teeth have, been much worn by long use, tends more or less completely to disappear.

THE MUSK-SHREWS.

Genus *Crocidura*.

With the musk-shrews, which include by far the largest representatives of the entire family, we come to the first members of the group characterised by their white teeth. No representatives of the musk-shrews occur in Britain, although the spider musk-shrew (*Crocidura aranea*), represented on the left side of the illustration on p. 325, and the common musk-shrew (*C. suaveolens*), shown in the accompanying



THE COMMON MUSK-SHREW (nat. size).

figure, occur on the continent of Europe. These shrews, which are of terrestrial habits, have either thirty or twenty-eight teeth, well-developed ears, and a long tail, and are covered with a coat of mingled long and short hairs. The eyes are very small, and placed nearer to the ears than to the tip of the nose. Each side of the body is furnished with a gland (sometimes absent in the female), secreting the musky product from which these shrews derive their popular name.

More than eighty species of musk-shrews have been described; the range of the genus embracing Southern and Central Europe, Africa, and Asia. The species with the widest range is the spider musk-shrew, above-mentioned, which is found from North Africa and Central and Southern Europe to Central Asia, extending as far north as North-Eastern Siberia, and as far south as Ladak. It belongs to the typical group of the genus, characterised by having only three small conical teeth behind the large first upper incisor; and it is a comparatively small species, of about

3 inches in length, exclusive of the tail. This shrew frequents cultivated grounds in Europe, not unfrequently entering houses; and preys on insects, worms, and the young of the smaller Mammals and Birds. The young are born in summer, and vary from five to as many as ten in number.

The common musk-shrew (*C. suaveolens*), of which a figure is given on p. 329, is the second representative of the genus *Crocidura* in Europe. It belongs to a group characterised by the presence of four small conical teeth, of which the hindmost is very minute, behind the first upper incisor tooth.¹ This group, which is numerously represented in India, includes the largest of all shrews, and those most strongly scented with the characteristic musky odour. The best known, and at the same time the largest, of these Indian species are the brown musk-shrew (*C. murina*), and the grey musk-shrew, (*C. corradæa*), the latter of which is commonly termed by Anglo-Indians the musk-rat. Both these species have nine teeth on each side of the upper jaw, and their length may be as much as 6 inches exclusive of the tail. Whereas the hair of the former is of a brownish tinge on the body and feet, in the latter it is more of a slaty hue; while the feet are flesh-coloured or yellowish-white. In other respects these two shrews are very closely allied, but whereas the brown musk-shrew is found as a rule in woods (although it will occasionally enter buildings), the grey musk-shrew generally, if not invariably, haunts human habitations. It has accordingly been suggested that the latter is merely a peculiar variety of the former. The grey musk-shrew is nocturnal, and is a common visitor to Indian houses. During the day it lies concealed in holes and drains, issuing forth at night to hunt over the floors of rooms for cockroaches and other insects; while thus engaged it utters from time to time a short, sharp squeak. In respect of its insect-eating habits, this musk-shrew is a benefactor to mankind; but these benefits are accompanied by the drawback that various articles may be so impregnated with the musky secretion of the animal as to become utterly useless. There has, however, been much exaggeration as to the penetrating power of this scent, the well-known but absurd story that wine or beer becomes impregnated with a musky flavour from the circumstance of one of these shrews having run over the outside of the bottle containing such liquor, being a case in point. In addition to its favourite cockroaches and other insects, the grey musk-shrew will also readily devour meat, and accounts are on record of an attack made by one of these animals on a frog, and by another on a snake.

Other Indian musk-shrews belonging to the same group of the genus, such as Blyth's musk-shrew (*C. fuliginosa*) have but eight teeth on each side of the upper jaw, or the same number as in the European spider musk-shrew (*C. aranea*).

THE BURROWING SHREWS.

Genus *Anurosorex*.

The burrowing shrews are small mole-like creatures, inhabiting Tibet, Western China, and Assam, where they are apparently very rare. They are characterised by their large heads, minute eyes, the absence of ear-conchs, a very short tail, and

¹ In the figure of the jaw of a true shrew (*Sorex*) on p. 323 there are five of these small teeth.



thick velvety fur. The total number of teeth is twenty-six, of which there are seven on each side of the upper jaw. There are only two species, of which the one from Assam measures about 3 inches in length, exclusive of the stumpy tail, and is of dark slaty colour, with a tinge of brown.

The interest attaching to these shrews arises from the circumstance that their structure is indicative of burrowing habits like the mole, although nothing is known on this point from actual observation.

THE SWIMMING-SHREWS.

Genus *Chimarrogale*.

Although the name swimming-shrews would be equally applicable to the water-shrews (*Crossopus*), and the latter name to the members of the present genus, yet it is convenient to take the two terms with the signification here given. The swimming shrews, of which one species (*Chimarrogale himalayica*) is found in the Himalaya and Mount Kina Balu in Borneo, and the other (*C. platycephalus*) in Japan, closely resemble the water-shrews in general appearance, but are distinguished by the teeth being entirely white, and likewise by being twenty-eight, instead of thirty in number. These shrews have a small external ear-conch; broad scaly feet, with a fringe of coarse white hairs on their margins, and on the sides of each toe: and the long tail is also fringed with similar hairs. The individual toes are, however, not connected together by webs.

The Himalayan swimming-shrew has a slaty-grey fur above, with the tips of the hairs blackish-brown. A female measured a little over 4½ inches in length, exclusive of the tail, the length of the latter being 3 inches; but it is probable that other individuals are considerably larger. This shrew inhabits the south-western portions of the Himalayan range, at elevations from three thousand to five thousand feet above the sea-level; and it is also found in the hills of North Burma. It inhabits the banks of streams, and, doubtless, swims quite as well as the European water-shrew. Dr. Anderson has observed it plunging into the water, and running over the stones on the bed of a stream. Like its European cousin, it is said to feed on aquatic insects and their larvæ, as well as on tadpoles, and the smaller fish and their fry. The assumption of aquatic habits by members of both the red-toothed and white-toothed sections of the shrews is an interesting example of how animals belonging to different groups may acquire almost exactly similar external characters, as being essential to their particular mode of life.

THE WEB-FOOTED SHREW.

Genus *Nectogale*.

A still further modification for the purposes of an aquatic life is exhibited by the web-footed water-shrew (*Nectogale elegans*) of Tibet, of which a group is shown in our coloured Plate. In these shrews not only are the feet and tail fringed with hairs, but the external conchs of the ears are wanting, and the toes are completely joined

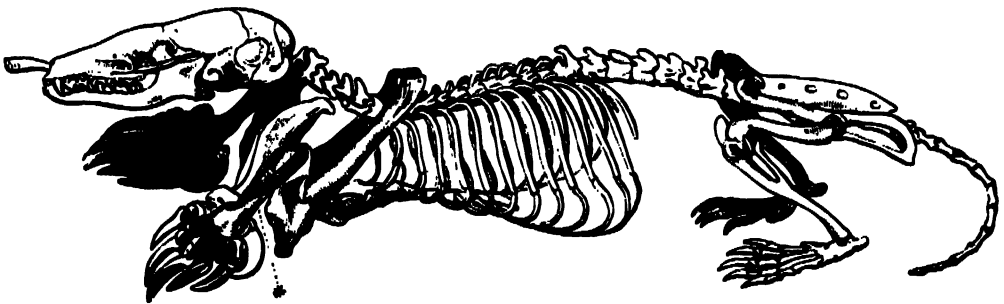
by webs, while the soles of the feet are furnished with large disc-like pads. The web-footed shrew has a tail of 4 inches in length, while the length of the head and body is but just over $3\frac{1}{2}$ inches. The fur, which is extremely dense and soft and evidently adapted to withstand the icy cold of the Tibetan rivers, is of a rich dark brown colour above, with the longer hairs of a glistening white, while the chin and throat are whitish, and the belly light brown.

It does not appear that this shrew has ever been seen by Europeans disporting in the waters of its native streams. From its structure we may, however, confidently infer that it is more thoroughly aquatic than any other member of the family; and it has been suggested by Milne-Edwards, its original describer, that the disc-like pads on the soles of the feet act as suckers, and thus enable the animal to cling to the surfaces of smooth pebbles or rocks during its sojourn beneath the water.

THE DESMANS AND MOLES.

Family *TALPIDÆ*.

The European desmans and the more widely-spread moles are the best known representatives of two sections of a family which, while allied in many respects to the shrews, possess characters of sufficient importance to justify its separation



SKELTON OF MOLE.

therefrom. In the first place, the skull in all members of the family *Talpidae* is distinguished from that of the *Soricidae* by having a distinct zygomatic arch connecting the upper jaw with the region of the ear; this difference being distinctly shown by a comparison of the figure of the skeleton of the mole given herewith with that of the skeleton of the water-shrew on p. 324. Then, again, on the under-surface of the hinder part of the skull, whereas the so-called bulla of the internal ear is represented in the shrews merely by an open ring, in the desmans and moles it has a complete bladder-like form. Further, the first incisor tooth of both jaws in the members of the present family is of a normal type, and never assumes the peculiar form which has been shown to be characteristic of all the shrews.

Most of the members of the present family are of fossorial habits, although a few are more or less completely aquatic, and others cursorial. All have long shrew-like skulls, and small eyes and ears; while in most cases the fore-limbs are placed

very far forward on the body, and are more or less specially modified for the purpose of digging in the ground. The family, although by no means so numerous in species as the shrews, is a comparatively large one, containing at least eight distinct generic modifications. It is entirely confined to the Northern Hemisphere, where it is widely distributed over the temperate regions of Europe, Asia, and North America.

THE DESMANS.

Genus *Myogale*.

The strange-looking desmans, of which there are two species, are aquatic animals belonging to a section of the family characterised by the fore-limb not



RUSSIAN DESMANS ($\frac{1}{2}$ nat. size).

being specially modified for the purpose of digging, and thus forming a connecting link between the shrews and the moles. This absence of special modification is exhibited by the bones of the skeleton of the fore-limb, in which the collar-bone (clavicle), and the arm-bone (humerus) still retain a distinctly elongate form, while there is no additional bone in the fore-foot.

The desmans are provided with the typical number of forty-four teeth, and are further characterised by their completely webbed feet, their long trunk-like snout, which projects far in advance of the upper lip, and the elongated and scaly tail. The

Russian Desman. Russian desman (*Myogale moschata*) is considerably the larger of the two, its total length being about 16 inches, of which some 6 $\frac{1}{2}$ are occupied by the tail. The fur is dense and thick, like that of an otter, with the outer portion formed of long stiff hairs, and the under-coat soft and woolly. Above, it is of a full reddish-brown, and beneath of an ashy-grey, with a silvery lustre

when viewed in certain lights. The first incisor tooth in each jaw is very large and powerful, the upper one being somewhat chisel-shaped. The tail is laterally flattened. This species inhabits the banks of streams and lakes over

Habits.

a large portion of South-Eastern Russia, dwelling in holes after the manner of the water-vole, and being as much at home in the water as an otter. Indeed, the greater part of the creature's time appears to be spent in that element; the burrow, which terminates in a large chamber above the level of the water, being chiefly used as a resting and breeding-place. Its chief food consists of aquatic insects and their larvæ, although it probably also devours small fish. Insects and larvæ are sought after by means of the proboscis-like snout, which is used to probe under stones and in chinks and hollows. A sharp hissing sound is given forth when the animal is irritated or disturbed. The specific name of the desman is derived from the musky odour produced by the secretion of a large gland situated beneath the rest of the tail: this taint rendering its flesh quite uneatable. Owing to its beautiful fur, which is not unlike that of the otter or beaver, the Russian desman is largely hunted by the peasants of the regions where it is found; early autumn being the season when the fur is in the finest condition.

Although now confined to the steppes of South-Eastern Russia, it is remarkable that the Russian desman once extended as far westwards as the British Isles, its fossilised remains having been obtained from the so-called forest bed of the Norfolk coast, which was deposited during the epoch immediately preceding the Glacial period. Remains of extinct species of the genus have also been obtained from the Tertiary deposits of the continent as far back as the lower portion of the Miocene period.

Pyrenean Desman.

Far smaller than the Russian species is the Pyrenean desman (*M. pyrenaica*), found on both the French and Spanish flanks of the mountain range from which it derives its name. In total length this animal does not much exceed 10 inches, of which about half is formed by the tail. It is, however, also distinguished from its larger relative by the greater proportionate length of its proboscis, and likewise by the tail being perfectly cylindrical. In mode of life the two species seem to be very similar, although it has been stated that the smaller one has a more marked preference for a diet of fish.

THE MOLE-SHREWS.

Genera *Urotrichus* and *Uropsilus*.

A very brief notice must suffice for the curious mole-shrews, which closely connect the moles with the shrews. The true mole-shrews, of which there are two species, constitute the genus *Urotrichus*, and are respectively found in Japan and North America. They have 36 teeth, of which 2 are incisors, and either 3 or 4 cheek-teeth on each side; and they are further characterised by their broad and unwebbed fore-feet and fossorial habits. They are mole-like in appearance and of small size. The Tibetan mole-shrew (*Uropsilus noricipes*) is the sole representative of a distinct genus differing from the last by having only thirty-four teeth, a narrow fore-foot, and a naked and scaly tail. In habit it is cursorial; and while

in external appearance it resembles a shrew its skull and teeth are like those of a mole. Its general colour is slaty-grey.

THE WEB-FOOTED MOLES.

Genus *Scalops*.

With the web-footed moles of North America we come to the first representatives of the second section of the family, characterised by having the collar-bone (clavicle) and arm-bone (humerus) so shortened and widened as to have lost all resemblance to the ordinary form; and also by the presence of an additional sickle-shaped bone on the inner side of the fore-foot, next to the thumb, both these features being intimately connected with the purely fossorial habits of all the members of this section of the family.

Structure.

All the moles, whether they belong to the New World or the Old World group, are characterised by their peculiar form, which, as we shall mention later on, is so admirably adapted for their mode of life. All have the fore-paws naked and of enormous width and strength; while in all there are no external ear-conchs, and the small and useless eyes are deeply buried beneath the fur, and are often further protected by an investing membrane. Then, again, these animals are characterised by the extreme thickness and density of their short velvet-like fur, to which no fragments of the soil through which the burrows are driven ever adheres. Like the New World moles, the web-footed moles are distinguished from their cousins of the Old World by the circumstance that the first incisor tooth in the upper jaw is of much larger size than the second. The special characteristics of the web-footed moles are that they have only 36 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, and $\frac{1}{4}$ cheek-teeth; and that the hind-feet are webbed, and the tail is short and nearly naked.

Habits.

The common web-footed mole (*Scalops aquaticus*) doubtless received its specific name on account of its webbed hind-feet, which led to the very natural inference that it was a swimming animal. But according to Dr. Hart Merriam, this is a complete misnomer, for not only is this mole "not known voluntarily to swim, but in the selection of its haunts it shows no preference for the vicinity of water, but manifests rather a contrary tendency. Its home is under ground, and its entire life is spent beneath the surface. Its food consists almost wholly of earth-worms, grubs, ants, and other insects that live in the earth and under logs and stones. It is almost universally regarded as an enemy to the farmer, and is commonly destroyed whenever opportunity affords; for, notwithstanding the fact that it subsists upon insects that injure the crops, it is nevertheless true that, in the procurement of these, it disfigures the garden paths and beds by the ridges and little mounds of earth that mark the course of its subterranean galleries, and loosens and injures many choice plants in its probing for grubs amongst their roots." The nest of this mole, "is commonly half a foot or more below the surface, and from it several passages lead away in the direction of its favourite foraging-grounds. These primary passages gradually approach the surface, and finally become continuous with, or open into, an ever-increasing

multitude of tortuous galleries, which wind about in every direction, and sometimes come so near the surface as barely to escape opening upon it, while at other times they are several inches deep. Along the most superficial of these horizontal burrows the earth is actually thrown up in the form of long ridges, by which the animal's progress can be traced. The distance that they can thus travel in a given time is almost incredible. Audubon and Bachman state that they have been known, in a single night after a rain, to execute a gallery several yards in length; and I have myself traced a fresh one nearly one hundred yards. The only method by which we can arrive at a just appreciation of the magnitude of this labour is by comparison: and computation shows that, in order to perform equivalent work, a man would have to excavate in a single night a tunnel thirty-seven miles long, and of sufficient size to easily admit of the passage of his body."

THE HAIRY-TAILED MOLES.

Genus *Scapanus*.

The hairy-tailed moles, of which there are two species inhabiting the United States, form a connecting link between the web-footed and the star-nosed moles, having the general external appearance of the former, but the same number (forty-four) of teeth as in the latter. The habits of the common hairy-tailed mole (*S. americanus*) appear very similar to those of the web-footed moles; both inhabiting dry meadow-land in preference to the swampy ground affected by the star-nosed mole. The mounds of the hairy-tailed moles do not, however, contain the central and surface opening of those of the web-footed moles; neither do the former animals indulge in the midday excursions so characteristic of the former.

THE STAR-NOSED MOLE.

Genus *Condylura*.

The last of the three genera of North American moles is represented only by a single species, the star-nosed mole (*Condylura cristata*), so called on account of the peculiar ring of riband-like appendages surrounding the end of the muzzle, in the middle of which are situated the nostrils. In addition to this feature, this mole is characterised by the tail being nearly as long as the body, and also by the circumstance that the bones of the terminal joints of the fingers are not cleft at their extremities, as they are in the Old World moles. Like the latter, the star-nosed mole possesses the typical number of forty-four teeth. In length this species measures about 5 inches, exclusive of the tail.

Habits.

The food of this mole consists entirely of earth-worms and insects, and its habits are very similar to those of the web-footed mole, although it does not apparently make such extensive excavations, and the hillocks thrown up from the runs are of larger size. In gardens and arable land these moles tunnel near the surface, throwing up a ridge of loose earth along the line of their tunnels, but in pasture land they work at a lower level. In both these respects they

resemble the common European mole, with which they also agree in that, during the late autumn, when the surface of the ground becomes frozen, they follow the worms downwards until a plane is reached where the frost has not penetrated. By following the ridge of loose earth which marks the progress of one of these moles in a garden, and quickly sinking a spade in the creature's path, a few inches in advance of the moving earth, it is frequently possible to turn a specimen out upon the surface. So quickly, however, do these animals pass through the soft soil of a garden, that the spade, although aimed several inches in front of the moving earth, will not unfrequently cut them in two.

Although the precise function of the peculiar disc of tentacles round the muzzle is not yet definitely ascertained, it appears highly probable that it acts as a sensitive organ of touch to aid its owner in discovering the whereabouts of the worms and insects encountered during its subterranean wanderings. In the newly-born young these tentacles are so small as to be scarcely perceptible. A nest examined by Dr. Merriam contained three young ones.

THE TRUE MOLES.

Genus *Talpa*.

The Old World moles may be at once distinguished from all their North American cousins by having the first upper incisor tooth scarcely larger than the second. With the exception of a single species from Eastern Tibet, the whole of the Old World moles are included in the genus *Talpa*, of which the typical representative is the common European mole (*T. europæa*). The members of this genus, nine in number, are distributed over temperate Europe and Asia, two of the Asiatic species being found to the south of the Himalaya. As a rule, there is the typical number of forty-four teeth, but a few of the species have not quite so many, owing to the loss either of the lower canine tooth or of the first upper premolar; while in one species the first premolar is wanting in both jaws. All are characterised by the width of the fore-foot.



UPPER AND LOWER SURFACE OF RIGHT FORE-FOOT OF MOLE.

As we entered at considerable length into the structure and habits of some of the American moles, our remarks on those of the Old World may be comparatively brief, as there is a great similarity between the two. It is remarkable that, as the European hedgehog differs from all the other species of its genus, so the European mole is distinguished from all its congeners by the absence of a membrane covering the eyes. Nearly or all the moles are normally black in colour, with a more or less pronounced greyish lustre when viewed in certain lights; but pied, buff, or white varieties are not very uncommon. The naked feet are flesh-coloured. The different species of moles show considerable variation as regards the relative length of the tail. Thus, whereas in the European mole the length of the head and body is about 5 inches and that of the tail 1 inch, in the Himalayan short-tailed mole (*T. micrura*) the naked tail is

less than a quarter of an inch in length, and is completely concealed among the fur of the body.

Distribution. The European mole is remarkable for its wide geographical distribution, ranging from England in the west, through Asia north of the Himalaya to Japan, and extending northwards as far as the Altai Mountains. Like its cousin, the common shrew, it is, however, unknown in Ireland. The "runs" of the European mole are very similar to those of the American moles already referred to, but the central chamber, or dwelling-place, is of a more complex structure. As this dwelling-place will be found described in detail in almost all works treating of the mole, it will suffice to mention here that it is usually placed near a hillock, or between two trees, and is composed of a central chamber with passages



THE COMMON MOLE ($\frac{2}{3}$ nat. size).

conducting to two circular galleries placed one above another. The higher of these two galleries has a smaller diameter than the lower one. From the larger lower gallery there are given off several diverging runs, one of which is larger than either of the others, and is known as the main run, being the one which alone leads to the burrows driven in various directions for the purpose of procuring food. These burrows, or runs, except when so close to the surface as to allow of the earth being raised directly upwards in the form of a ridge showing their course, are marked at intervals by the well-known "mole-hills," which are mounds of loose earth pushed up from below, and not containing any internal chamber or passages.

Since the voracity of the mole is proverbial, and its food consists exclusively of earth-worms, insects, and their larvæ, its visits ought to be welcomed alike by the farmer and the gardener. As a matter of fact, however, the mole has an awkward habit of driving its tunnels below the drilled rows of young farm and garden crops,

by which not only are the roots of the plants disturbed, but the whole row may be dried up. Moreover, it appears pretty certain that field-voles will take advantage of runs driven in such localities as convenient points from which to make inroads on the sprouting seeds or the roots of the young plants. Then, again, in addition to the unsightliness of a host of mole-hills in a garden, such elevations are inconvenient in a field of standing grass, as they impede the process of mowing. From these and other circumstances, farmers and gardeners generally unite in a war of extermination against the mole, although there can be no doubt but that in many respects its visits are a distinct advantage to its destroyers.

It is well known that male moles are more numerous than females, and this seems to be explained by a writer in the *Field* newspaper, who states that a family "of moles appears to consist of five members, in the proportion of four males to one female—this as a rule, though with many exceptions. In the course of my experience I have never caught more than five in succession in the same run; and this, therefore, appears to be the limit." It is well known that moles have the habit of feeding at regular hours during the day, and that they may be found at work at eight, twelve, and four o'clock. In regard to mole-catching, it is mentioned that, "when setting a trap in light crumbling soil, as in a flower-bed, care should be taken to remove only sufficient earth to allow of the trap being put in, and the hole leading each way should be carefully cleared, so as to allow the mole a free passage, or he will infallibly dive underneath your trap. A piece of slate put at the bottom of the run is a good preventive of this kind of thing." Like their North American relatives, moles swim well, and will take to the water readily.

According to Mr. Blanford, the short-tailed mole, which is abundant near the Himalayan station of Darjiling, at elevations of from about five thousand to eight thousand feet above the sea-level, "inhabits the deep bed of black vegetable mould found wherever the original forest has not been destroyed. This mould contains earth-worms and larvæ of insects, the chief food of moles, in abundance. Jerdon noticed that the runs of *T. micrura* often proceeded from the base of one great oak to that of another. Such runs are not marked by mole-hills, as in the case of the European species."

Extinct Moles. Fossil moles are found throughout the Tertiary strata of Europe from the Upper Eocene deposits of Central France. As far down as the succeeding Lower Miocene beds these extinct species seem to belong to the existing genus *Talpa*, but the Upper Eocene species, on account of the arm-bone (humerus) being rather less expanded, has been regarded as representing a distinct genus, *Protalpa*. The occurrence of these Tertiary moles is interesting, as they show how extremely ancient must be the insectivorous type of Mammals, since even at those early epochs the remarkable peculiarities distinctive of the skeletons of the existing members of the group had already attained their nearly complete development.

Yellow-Tailed Mole. Our notice of the Mole family may conclude by a reference to the yellow-tailed mole (*Scaptonyx fuscicaudatus*) of Eastern Tibet. This mole, which has only two pairs of lower incisor teeth, and consequently but forty-two teeth altogether, differs from the true moles in the considerably lesser width of the fore-feet, and thus approaches the mole-shrews noticed on p. 334.

THE TENRECS.

Family CENTETIDÆ.

With the curious-looking animal represented in the figure on the next page, we reach the first member of a group of Insectivores, comprising four families, which differ from all those yet noticed in the characters of their upper molar teeth. In all the preceding families the upper molar teeth have broad crowns, with their cusps arranged somewhat in the form of the letter W. On the other hand, in all those remaining for consideration, the crowns of these teeth are narrow, and carry on their crowns only three cusps, arranged in the form of the letter V. These cusps, or tubercles, thus form a triangle, with the apex directed inwardly; and this type of molar tooth, of which an example is represented in the accompanying illustration, is consequently known as the *tritubercular*. It may seem that such a point of distinction is of comparatively slight importance. Such, however, is by no means the case, since the researches of palæontologists have shown that nearly all the earlier Mammals had these tritubercular molar teeth, from which we infer that Mammals still retaining them in their primitive form belong to an extremely ancient stock.



CROWN-SURFACE OF
AN UPPER MOLAR
OF THE TRITUBER-
CULAR TYPE.

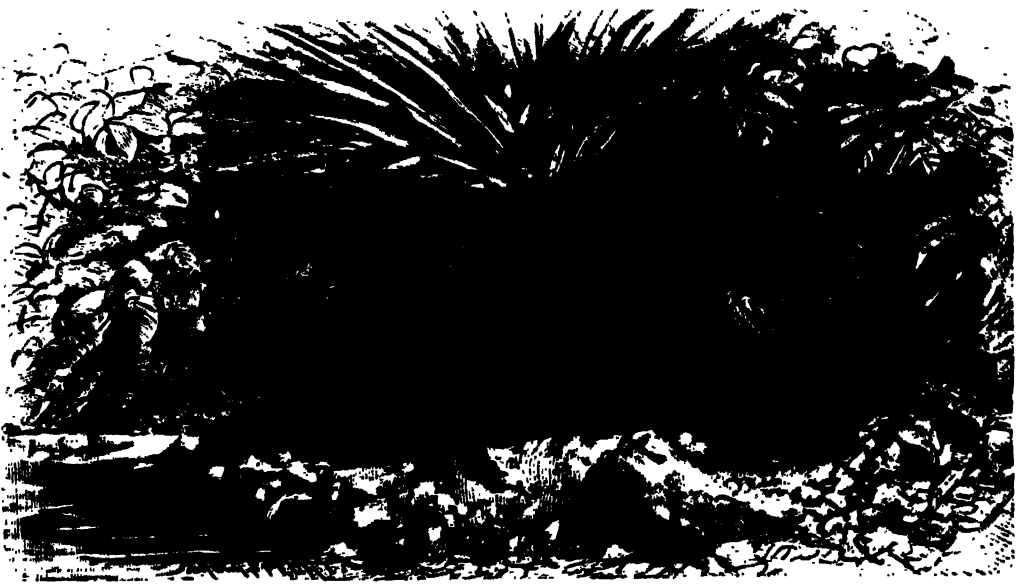
From this and other structural peculiarities it may be taken as certain that the Insectivores of the present and three following families belong to a much lower type of organisation than those already mentioned. And this is borne out in a remarkable manner by their geographical distribution. Africa, and more especially Madagascar, are characterised by the number of Mammals belonging to ancient and primitive types still living there, as is well exemplified by the host of lemurs found in Madagascar. Now of the Insectivores with tritubercular molar teeth, the present and largest family is restricted to Madagascar and a few of the neighbouring islands: a second is found both in Madagascar and Africa: the third is solely African: while the fourth is confined to the West Indies—a region also peculiar for the ancient types of its few Mammals. The whole of the tenrecs, which as already mentioned are confined to Madagascar and a few small islands in the vicinity, are characterised by their long skulls, which are not constricted between the eyes, and have no zygomatic arch below the socket for the eye to connect the upper jaw with the region of the ear, while the so-called tympanic bulla is in the form of a simple ring.

THE COMMON TENREC.

Genus *Ce*

This animal, which is the one represented in the illustration on p. 341, is readily recognised by its comparatively large size, and the total absence of a tail. It is the sole representative of its genus, and, from the feature last mentioned, is technically known by the name of *Centetes ecaudatus*. Adult males attain a length of upwards of 16 inches, and are thus the largest of all Insectivores. The body is

covered with a mixture of flexible spines, bristles, and hairs; but whereas in the young the former are arranged in longitudinal lines down the back, in the fully adult state they are restricted to a kind of collar round the upper side of the neck. Both spines, bristles, and hair are yellowish or whitish towards the tips, and brown near the middle, so that the general colour of the head and body is a kind of yellowish-brown. When fully adult, the tenrec has 40 teeth, of which on each side $\frac{2}{3}$ are incisors, 1 canines, and $\frac{1}{3}$ cheek-teeth. The tusks, or canines, of the males are very long and sharp, and would be capable of inflicting a severe wound. The most remarkable peculiarity connected with the dentition relates, however, to the upper cheek-teeth, and has only quite recently been discovered by Mr. O. Thomas. Thus in a middle-aged tenrec it will be found that there are six cheek-



THE TENREC ($\frac{1}{2}$ nat. size).

teeth behind the canine on each side of both jaws; three of these belonging to the premolars, or those preceded by milk-teeth, and three to the molar series, which have no such predecessors. Very late in life, however, a small fourth molar appears in the upper jaw behind the other three. Considering that no other Mammals with teeth divided into distinct series, have four upper molars as a normal condition, except Marsupials, and one peculiar kind of dog, this is a very remarkable circumstance. Taken, indeed, in conjunction with the fact that both the tenrec and the carnivorous Marsupials have tritubercular molar teeth, while the skulls of both have certain very remarkable resemblances, this feature in the dentition renders it pretty certain that of all living Mammals the tenrec is the one which is most nearly related to the Marsupials of Australia and America. Further collateral evidence of this relationship is, perhaps, afforded by the circumstance that the tenrec produces a large number of young at a birth; although in this respect it even exceeds the Marsupials, an instance being recorded when an

many as twenty-one young were brought forth at a single birth, fifteen or sixteen being the common number.

Habits.

Owing to its strictly nocturnal habits, our acquaintance with the mode of life of the tenrec is by no means so intimate as could be wished. It appears, however, that these animals are chiefly found in the mountains of Madagascar, where they inhabit low covert formed by ferns and bushes. Earth-worms form a large proportion of their diet, which is, however, extensively supplemented by insects; and it would seem that the worms and insects are rooted out from their holes and hiding-places by the aid of the flexible snout with which the tenrec is furnished. During the cooler season of the year the tenrecs hibernate for a long period, burrowing deep holes in the ground about May or June, from which they do not emerge till the following December. Whether this is to avoid a season of drought, when their natural food is difficult to procure, we are unaware. Like other animals, which enjoy a periodical rest, the tenrecs at the commencement of their hibernation are in a fat condition, and are then much sought after by the natives of Madagascar as an article of food; the whereabouts of their burrows being usually revealed by the heap of dirt or débris covering the entrance.

THE STREAKED TENREC.

Genus *Hemicentetes*.

The streaked tenrec (*Hemicentetes semispinosus*), together with a second nearly allied species (*H. nigriceps*), represent a genus distinguished from the preceding by having three, instead of two, upper incisor teeth, and probably only three upper molars; as well as by certain peculiarities in the structure of the skull, and the smaller size of the canine teeth, which are scarcely larger than the incisors, and cannot properly be termed tusks.

The streaked tenrec is an animal of about the size of the common mole, and derives its name from the streaks of black and yellow with which the body is ornamented. In this and the allied species the longitudinal rows of spines on the back, which disappear in the adult of the common tenrec, are retained throughout life.

The Hedgehog-Tenrecs.

The little animals known as hedgehog-tenrecs, are so like small hedgehogs in general appearance that they might be readily taken for members of the same family. Like hedgehogs, they have the whole of the upper surface and sides of the body covered with short, particoloured bristles; and they are also furnished with a short tail. Of more importance as a generic character, is the circumstance that there are only two incisor teeth on each side of both the upper and lower jaw. Although it is probable that these animals can to a certain extent roll themselves up into a ball, yet from the feeble development of the layer of muscle beneath the skin, Dr. Dobson is of opinion that this cannot be done so completely as in the case with the hedgehogs. Since it cannot be considered that the hedgehog-tenrecs are in any way nearly related to the hedgehogs, it is somewhat remarkable that both should have developed such exactly similar spines, which are used for defensive purposes in the same manner. The

common hedgehog-tenrec (*Ericulus setosus*) is about two-thirds the size of the European hedgehog, and has thirty-six teeth. Telfair's hedgehog-tenrec (*E. telfairi*) is considerably smaller, with only thirty-four teeth, owing to the absence of the first pair of premolars in the upper jaw.

The Long-Tailed Tenreca. Two small mouse-like animals from Madagascar, each having forty teeth, are distinguished from all the preceding members of the family by the absence of spines mingled with the fur, and also by the great length of the tail. In one of the species (*Microgale longicaudata*) the length of the tail is double that of the head and body—a proportion only equalled among the pangolins. Of the 40 teeth, $\frac{3}{8}$ are incisors, 1 canines, and $\frac{1}{2}$ cheek-teeth on either side.

The Rice-Tenreca. The last members of the *Centetidae* are the two small mole-like animals known as rice-tenreecs, distinguished by the extreme shortness of their tails, and likewise by their burrowing habits. The four-toed rice tenrec (*Oryzorictes tetradactyla*) is peculiar in having but four toes on the fore-feet, of which the three innermost ones are armed with powerful claws for digging. The second species (*O. hova*) has five front toes, but both agree in having long, trunk-like snouts. These animals are a great pest to the agriculturists of Madagascar, owing to the damage they inflict on the rice crops by burrowing in the earth beneath the young plants in search of worms and insects.

THE SOLENODONS.

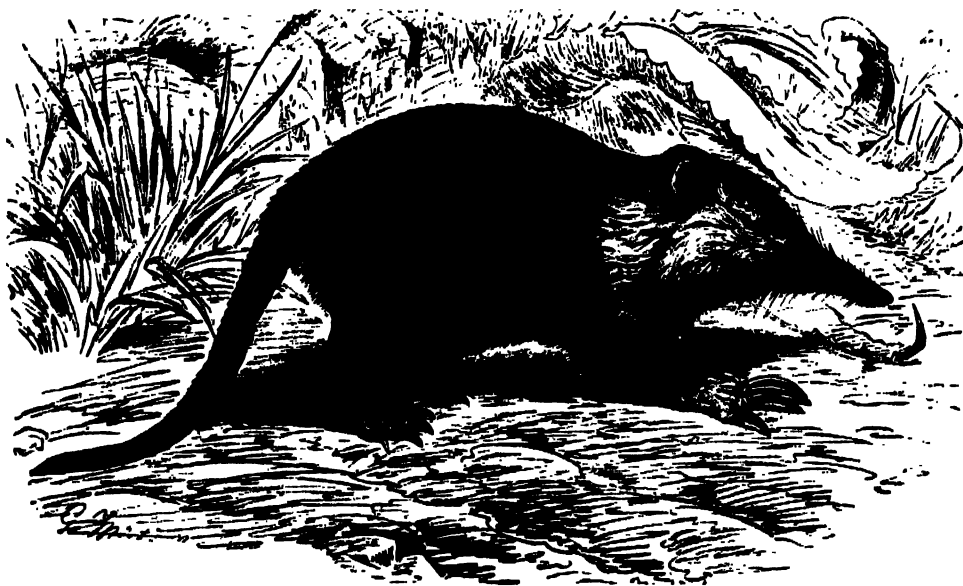
Family SOLENODONTIDÆ.

Strange as it may seem that the nearest relatives of the tenreecs of Madagascar should be found in a region so far removed from that island as the West Indies, yet it appears that the two solenodons really occupy this position: although in the form of the incisor, canine, and premolar teeth they approximate, very closely to the desmans (p. 333).

They have a total of forty teeth, corresponding serially with those of the long-tailed tenreecs: and they are distinguished from the *Centetidae* by the circumstance that the skull is somewhat narrowed between the eyes, and also by the mammae being entirely confined to the region of the groin, instead of extending on to the breast, as in all other members of the order. The snout is long, cylindrical, and trunk-like, with the nostrils situated on each side of its extremity: the tail naked, cylindrical, and of considerable length: and the toes, especially those of the fore-feet, are armed with powerful curved claws. The fur covering the body is long and coarse. The Haytian solenodon (*Solenodon paradoxus*) is restricted to the island of Hayti, and was the first known of the two species. It may be compared in size to a small rabbit, the head and body measuring about 12 inches, and the tail about 8. The head and upper-parts are brown, becoming blackish behind and on the thighs: while the sides of the head and under-parts are lighter in colour.

The Cuban solenodon (*S. cubanus*), is distinguished by the whole of the head, neck, and chest being tawny, or yellowish, while the remainder of the upper part and sides of the body is dark blackish-brown. The nature of the fur is also some-

what different from that of *S. paradoxus*. It is found in the mountains of the southern and western portions of the island from which it takes its name, and it issues forth from its diurnal resting-place during the late afternoon and early evening, to spend the night in search of food. From the readiness with which, when in captivity, it will tear in pieces meat that is offered to it, it may be inferred that in the wild state its food is not restricted to insects.



THE CUBAN SOLENODON ($\frac{1}{2}$ nat. size).

THE POTAMOGALE.

Family *POTAMOGALIDÆ*.

The curious aquatic Insectivore from West Africa, discovered by Du Chaillu, and named by him *Potamogale*, differs so much from all other members of the order that, like the solenodons, it forms the representative of a distinct family. *P. velox* may be recognised by its otter-like form, and long laterally compressed tail, passing almost imperceptibly into the body. In size it is rather large for an Insectivore, the length of the head and body being 11 inches, and that of the tail nearly the same. It has a total of forty teeth, which have the same serial arrangement as in the long-tailed tenrecs, and are placed very near together. The head is characterised by the great width of the broad muzzle, which is provided with a number of large bristles, and has its nostrils closed by valves. The body is long and cylindrical, and the limbs are short, with the toes not connected together by webs. The body is covered with a coarse outer coat of long hairs and an inner one of a finer and softer nature: the colour of the upper-parts being dark brown, while the under-parts are whitish. In certain lights, however, the dark portion of the pelage is shot with a purplish metallic tint. The skeleton of the potamogale

differs from that of all other Insectivores, except, probably, that of the under-mentioned geogale, by the total absence of collar-bones.

Habits.

The compressed tail becoming cylindrical at its base to join the body, together with the presence of valves to close the nostrils, would alone suffice to indicate the aquatic habits of this curious creature. In addition, we have, however, the direct testimony of Du Chaillu, who observes that the potamogale "is found along the water-courses of limpid and clear streams, where fish are abundant. It hides under rocks along these streams, lying in wait for fish. It swims through the water with a rapidity which astonished me; before the fish has time to move it is caught. On account of the rapidity of its movements I have given it the specific name of *velox*. The animal returns to land with its prey almost as rapidly as it started from its place of concealment. The great motive-power of the animal in the water seems to be in its tail."



THE POTAMOGALE ($\frac{1}{4}$ nat. size).—After Allman.

Geogale.

Probably more or less closely allied to the potamogale is a small mouse-like Insectivore from Madagascar, described under the name of *Geogale*. This creature has thirty-four teeth, which resemble in form those of the potamogale, but our information is at present insufficient to render us certain as to its full affinities.

THE GOLDEN MOLES.

Family *CHRYSOCHLORIDÆ*.

The golden or Cape moles, constituting the genus *Chrysochloris*, are so different from all other Insectivores of this group that they are referred to a distinct family. They are entirely confined to South Africa, where they are represented by about seven species, and are commonly termed moles by the colonists.

The skull of the golden mole differs from that of the tenrec in possessing a distinct zygomatic arch below the socket for the eye, and also in that its tympanic bulla is bladder-like. In appearance these animals have some resemblance to the moles, but they have shorter and thicker bodies, with a deeper head and blunter snout. The whole form is, however, admirably adapted for tunnelling through the ground; since the eyes are totally covered beneath the hairy skin, and the minute ears are deeply buried in the fur. While the hind-feet retain a normal form, the fore-feet have been specially modified for the purpose of digging, having only four toes, of which the two central ones are furnished with enormous triangular claws of great power. The more typical species have altogether forty teeth, but

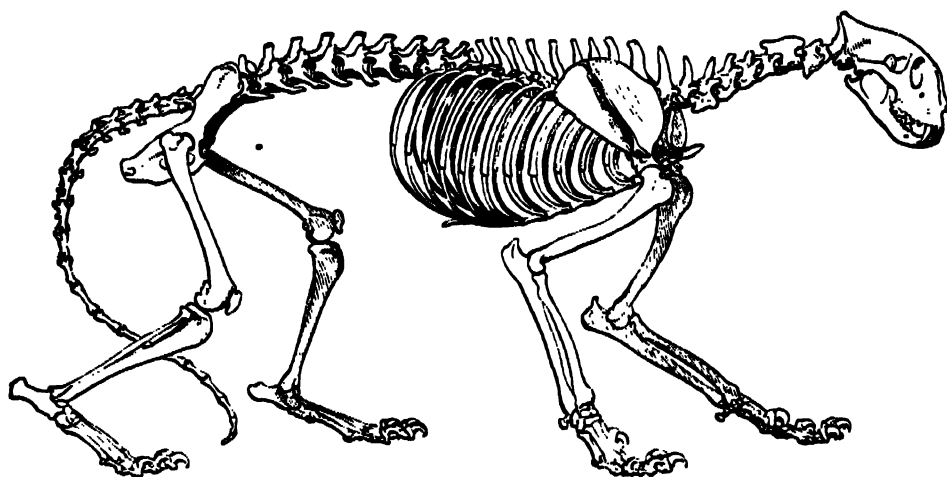
in others the number is reduced to thirty-eight, owing to the loss of the first pair of premolars in each jaw. The molar teeth have very tall crowns. The golden moles derive both their popular and scientific names from the brilliant metallic lustre of the fur, which shows various tints of green, violet, or golden bronze: the brilliancy of these metallic hues being much intensified when the skin is immersed in spirit.

Habits. The runs are made so near the surface of the ground that the earth is raised above the tunnel, which can accordingly be followed with ease in all directions. When one of the moles is seen to be at work, owing to the movements of the soil, it can readily be thrown up on to the surface by the aid of a stick or spade. The food of the golden moles consists mainly of earth-worms.

The nearest relatives of the golden moles appear to be the tenrecs, while the ordinary moles are closely allied to the shrews; and it is thus interesting to find two widely different groups of animals modified for a similar kind of subterranean life. This modification has, however, by no means followed the same lines in the two groups, for not only do the skeletons of the golden and true moles differ considerably from one another, but there is a still more marked difference in the form and structure of the fore-foot. Thus, whereas the fore-foot of the true mole has assumed the well-known hand-like form, with an additional sickle-like bone near the thumb, that of the golden mole, as we have just seen, is of a totally different type, the power of digging being mainly due to the enormous horny claws of its two middle fingers.



LION AND LIONESS.



SKELETON OF TIGER.

CHAPTER XIII.

THE CARNIVORES,—Order CARNIVORA.

THE CAT-TRIBE.

Family *FELIDÆ*.

UNDER the common title of Carnivores, or Flesh-eaters, zoologists include all the members of that extensive assemblage of placental¹ Mammals, comprising cats, civets, hyenas, dogs, bears, weasels, etc., together with their aquatic allies the seals and walruses. The name refers to their most distinctive habit, that of subsisting on the flesh of other animals; but it must by no means be assumed that all Carnivores are entirely or even chiefly flesh-eaters, the bears being notable exceptions. Neither must it be assumed, on the other hand, that the Carnivores are the sole flesh-eating Mammals; since, as we have seen, many of the Lemurs and Insectivores will eat the flesh of other Vertebrates, while one group of Marsupials is almost exclusively carnivorous. With the exception of the members of the last-named group, which are otherwise broadly distinguished, there is, however, no assemblage of Mammals which is so generally carnivorous as the present one, and accordingly the name by which it is designated is the most appropriate that could have been selected.

¹ The term "placental" refers to the circumstance that the embryos of the higher Mammals are connected during intra-uterine life with the body of the female parent by means of an organ called the placenta, through which the blood of the parent communicates with that of the offspring. The Marsupials have no such connection.

There has been a considerable amount of—more or less unprofitable—discussion as to whether the Carnivores, or Apes and Monkeys, are entitled to occupy the highest place among Mammals. Putting man on one side, there can, however, be but little doubt that, for their particular mode of life, the higher Carnivores, both as regards their bodily structure and their brain power are fully as highly organised as the Apes; and to say that the one group is higher or lower than the other is thus practically an impossibility. A more just view is to compare the Carnivores and the Primates with two trees of different kinds, each of which has attained practically the same height, and bears fruit and flowers of an equally perfect development.

Had we to deal only with the existing forms of the animal kingdom, and if the seals and walruses were excluded (as is done by some zoologists) from the Carnivores, there would be no great difficulty in giving a short and concise definition which would at once distinguish the order from all the others. The seals and walruses differ, however, so markedly in the characters of their teeth, as well as in many other structural points, from the more typical Carnivores, while a number of extinct forms appear to connect the latter on the one hand with the Insectivores, and on the other with the Marsupials, that any such concise definition is impossible.

Among the characteristics common to all Carnivores, whether terrestrial or aquatic, the following are some of the most important. In all cases the toes are provided with claws, which are very generally sharp and curved, with no resemblance to nails. Then, again, the number of complete toes is never less than four to each foot, and is frequently five. And in no case is the first toe capable of being opposed to the other digits: so that a Carnivore can in no sense be said to have a *hand* in the popular acceptance of that term.

The teeth, in conformity with the flesh-eating habits of the great majority of the members of the order, are generally large and well developed; and are always divisible into incisors, tusks or canines, and cheek-teeth. As a general rule, the incisor teeth are three in number on each side of both the upper and lower jaws, and in no case do they exceed this number;¹ while the third or outermost of these three incisors is always larger than either of the others, more especially in the upper jaw. The tusks are large, and adapted for seizing and retaining the prey of these animals. The different families of the order show a considerable diversity in the form and structure of the cheek-teeth: but, as a general rule, the more anterior of these teeth have sharp and more or less compressed crowns, while very frequently, as will be explained later on, one pair of teeth in each jaw is specially modified to bite with a scissor-like action against an opposing pair in the opposite jaw. Moreover, in such Carnivores as have the crowns of the molar teeth flattened and expanded, these crowns are not divided into distinct portions by infoldings of the enamel, as we shall find to be so frequently the case with those of the Rodents.

The most distinctive feature of the skull of the Carnivores is to be found in the mode of articulation of the lower jaw: the condyle, or projecting process by which the latter hinges on to the skull proper, taking the form of a half-cylinder, elongated in the transverse direction. This half-cylinder is received into a similarly

¹ The Marsupial Carnivores never have less than four pairs of incisor teeth in the upper jaw.

shaped hollow—the glenoid cavity—in the skull, bounded by overhanging edges. In consequence of this arrangement, the motion of the lower jaw of a Carnivore is strictly limited to an up-and-down direction: thus allowing only of a biting or snapping action, and not permitting that rotatory or backwards-and-forwards movement found in so many other Mammals. The interlocking of the lower jaw with the skull is most marked in the badgers.

A less important feature of the carnivorous skull is to be found in the circumstance that in the great majority of instances the orbit, or the cavity for the eye, is not bounded posteriorly by a bar of bone so as to form a complete ring, but communicates freely with the greatly elongated hollow on the side of the skull which contains the powerful muscles for working the jaws. Occasionally, however, as in some cats and the ichneumons, the eye-socket is completely surrounded by a bony ring; and a process at the back of the upper part of the cavity for the eye always marks the posterior limit of that cavity. More constant is the presence of a strong zygomatic arch bounding the inferior border of the socket of the eye, and connecting the upper jaw with the region of the ear.

An important feature distinguishing the skeleton of a Carnivore from that of an Insectivore (with the exception of the potamogale) is that the collar-bones or clavicles are frequently absent, and when present are never complete: that is to say, that instead of each collar-bone forming a bar to connect the shoulder-blade with the breast-bone, as in ourselves, when it exists at all it merely forms a little splint of bone embedded in the muscles of the chest between these two points.

Two other features in regard to the skeleton must not be overlooked, since they are of some help in distinguishing between Carnivores and Insectivores. In many of the latter, as shown in the figure of the skeleton on p. 332, the two bones of the fore-arm (radius and ulna), and of the lower leg (tibia and fibula) are respectively united together, whereas in all the former they are completely separate. In the fore-limb this separation of the two bones is essential in order to permit of the free use of the paw. A characteristic of the wrist-joint of all Carnivores is that two of the bones of the upper row, respectively known as the scaphoid and the lunar, are completely welded together: and it may be added that the central bone, which we have seen exists in all the lower Primates, is invariably absent. Another feature distinguishing the Carnivores from the Insectivores is to be found in the well-marked convolutions on the upper surface of the lobes of the brain, which is indicative of a far higher degree of mental power.

With the exception of Australia and New Zealand, Carnivores are distributed over all the continents and larger islands of the globe, ranging from the icy ocean of the Arctic circle to the tropical plains of Africa and India; but while some of the families, like the cats and dogs, have a distribution almost coextensive with that of the order, others, like the civets and hyenas, are much more restricted in their range. Exclusive of the larger Man-like Apes, the Carnivores include the largest of the so-called Unguiculate Mammals, that is, those in which the toes are furnished with claws or nails, in contradistinction to hoofs. As is usually the case, the largest representatives of the order are to be found in the aquatic section, where we have the walrus and elephant-seal. Among the terres-

trial Carnivores the largest species are to be found in the warmer parts of the globe, although the bears form, to a certain extent, an exception to this rule. The more typical and purely carnivorous terrestrial members of the order, which, as a general rule, subsist on the flesh of animals killed by themselves, are characterised by the elegance and neatness of their build, and their bodily strength and activity, as well as by the fierceness of their disposition.

The terrestrial, or, as they are often called, in allusion to their free toes, the Fissipede Carnivores, are, as a rule, adapted for a life on land, although some forms, like the otters, pass a large portion of their time in the water. In no instance, however, are their fore-limbs modified so as to assume the form of flippers, neither do their hind-limbs ever present the peculiar structure characteristic of those of the seals, being, on the contrary, invariably suited for walking with ease on the ground. Of more importance, however, is the structure of the teeth of the land



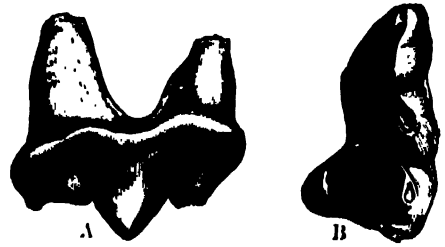
SIDE VIEW OF THE SKULL OF THE COMMON FOX.

To show the nature of the teeth of a Carnivore. The upper flesh-tooth is lettered *pm.4*, and the lower flesh-tooth *m.1*. (From *Proc. Zool. Soc.*—After Huxley.)

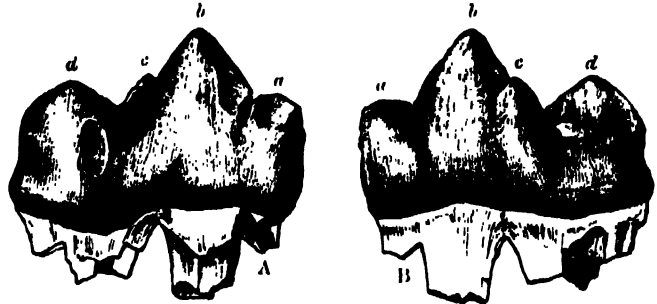
Carnivores. In the first place, the presence of three pairs of incisor teeth in both the upper and the lower jaw is an extremely constant feature. Then, again, instead of the uniformity pervading the whole series of cheek-teeth, which we shall find to be characteristic of the seals and their allies, the cheek-teeth of the terrestrial Carnivores of

the present epoch are distinguished by having one of their number on each side of both the upper and the lower jaw modified in a special manner so as to bite against one another in a more or less markedly scissor-like fashion. The tooth in the upper jaw thus specially modified is the last of those which have milk, or deciduous predecessors, and is thus the fourth of the premolar series in those species where four of those teeth are developed. This is shown in the accompanying figure of the skull of the fox, where the fourth upper tooth (*pm.4*) behind the tusk is the one specially modified. In the lower jaw, however, in those forms which have the full number of teeth, it is the fifth tooth (*m.1*) behind the tusk which bites against the specially modified tooth in the upper jaw, as shown in the same figure. This modified lower tooth, which has no deciduous milk predecessor, is thus the first of the molar series. To these two pairs of modified teeth is applied the name of *flesh-teeth*, as being those specially adapted for cutting the flesh of the victims of the terrestrial Carnivores. The upper flesh-tooth, as

exemplified in that of the striped hyæna represented in the accompanying woodcut, consists of an outer blade, and of a strong tubercle on the inner side. The blade, as in the figured specimen, may consist of three lobes, or as in the dogs and civets, of only two such lobes, which bite on the outer side of the lower flesh-tooth, in a manner well known to all who have ever examined the skull of a tiger, lion, dog, etc. The lower flesh-tooth, of which an example is represented in the next figure, likewise has a large cutting-blade on the outer side of its front portion, which is invariably divided into two distinct lobes, of which the second is generally the taller. In the more generalised Carnivores, such as the dogs, the second lobe of the blade of this tooth has a small cusp (*c*) on its inner side: while posteriorly the tooth is extended in the form of a long heel (*d*). The lower flesh-tooth of the more specialised forms, such as the hyænas and cats, consists, however, only of the two-lobed blades, with or without a minute inner cusp and a small hind ledge representing the heel.



OUTER (A) AND ORAL (B) ASPECTS OF THE RIGHT UPPER FLESH-TOOTH OF THE STRIPED HYÆNA.



OUTER (A) AND INNER (B) ASPECTS OF THE RIGHT LOWER FLESH-TOOTH OF AN EXTINCT DOG-LIKE CARNIVORE.

a, b, first and second lobes of the blades; *c* inner cusp of do.; *d*, heel.
After Kuhl.

Under the general title of cats it is found convenient to include all the living representatives of the extensive family of the *Felidae*, the whole of which, with the single exception of the hunting-leopard, are classed in the genus *Felis*. In this sense

lions, tigers, leopards, jaguars, pumas, lynxes, and the smaller species more nearly allied to the domestic cat, are all designated Cats.

The members of the Cat family may be regarded as the ideal representatives of the Carnivores, being those most completely adapted in all parts of their structure for the pursuit and destruction of living prey. Their long, lithe bodies exhibit in its fullest perfection the combination of strength and agility distinctive of Carnivores in general: while their strength is so great that the larger species are enabled to kill and drag away animals of far greater bulk than their own.

The essential characteristics of the living cats are to be found in the extreme shortness of their muzzles; in the reduction of the number of their teeth far below that in the more generalised Carnivores, such as the dogs; in the powerful development of their tusks and flesh-teeth: and in their strongly curved and retractile claws, as well as in the free and supple movements of their fore-paws. Omitting mention of certain features distinctive of the skulls of the cats and their nearest

allies, as requiring a considerable amount of special knowledge of osteology, we may particularise somewhat more fully the leading characteristics of the cats of the present day. And we say those of the present day advisedly, since the researches of paleontologists have now brought to light the remains of a large number of Carnivores, many of which, although they must undoubtedly be called cats, differ from the existing species by the greater number of their teeth, as well as by many other structural peculiarities, so as to render it difficult to draw any well-marked distinction between cats and civets.

We may first of all notice that, as a general rule, they have 30 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, $\frac{3}{4}$ premolars, and $\frac{1}{4}$ molars. Occasionally, however, there may be only 2 premolars on each side of the upper jaw, thus reducing the total number of teeth to 28. Thus a cat has at most only three or four cheek-teeth on each side of the upper jaw, of which the last but one is the flesh-tooth; while in the lower jaw there are but three of these teeth, of which the last is the flesh-tooth. The upper flesh-tooth is of the same general type as that of the hyæna's tooth shown in the woodcut on p. 353: its blade consisting of three distinct cutting-lobes, and usually having a distinct tubercle on the inner side, although this tubercle is always smaller than in the hyænas, and may be wanting. The lower flesh-tooth is also of the same general type as that of the hyænas (of which an example will be found figured under the head of that group), and consists only of the two-lobed blade, without any trace of the inner cusp or hinder heel, which form such important elements in the corresponding teeth of the dogs and civets. The flesh-teeth of the cats have, indeed, lost the whole of those elements which are adapted for masticating or bruising food, and are reduced simply to the condition of cutters. Moreover, the single molar remaining in the upper jaw is of such small size that it can be of but little, if any, use as a masticating agent: and we accordingly find that the dentition of the cats is adapted solely for seizing their prey, and subsequently devouring it by cutting off the flesh from the bones by the scissor-like action of the flesh-teeth. Any person who has watched a domestic cat eating a piece of meat, or who has observed a captive lion or tiger shearing off huge morsels from its allotted meal, will fully understand the mode of action of these teeth. In all cats the tusks, or canines, are very long and strong, and frequently have their hinder border forming a sharp cutting edge, by which their rending power is of course much increased. An important feature distinguishing the lower incisor teeth of the cats from those of all other Carnivores is to be found in the circumstance that the whole series of six are placed in the same straight transverse line, whereas in other Carnivores the second pair of these teeth is thrust up above the level of those on either side.

The fore-feet of all the cats are provided with five toes each, whereas the hind-feet have but four toes. The claws in which these toes terminate are invariably curved and sharp, and, with the single exception of the hunting-leopard, can be completely retracted within sheaths for their protection when not in use. The mechanism of the retraction of the claws is due to the peculiar shape of the terminal joints of the toes, and the mode by which they are articulated to the second joints. Thus the terminal joint of each toe has the broad sickle-like form of the horny claw which it supports, and it is articulated to the end of the second or preceding joint

only by the lower portion of its vertically expanded base. From the end of the second joint there runs a ligament to be inserted on the upper side of the base of the terminal joint, the ordinary action of which is to draw back the whole claw upon the upper surface of the second joint, when it becomes nearly concealed within its projecting sheath. To the under-side of the base of the terminal joint there is, however, inserted the end of a long tendon coming from one of the so-called flexor muscles of the fore-leg. When the animal springs upon its prey the paw, in the act of striking, is sharply bent upon the wrist by the action of these flexor muscles, the result of which is to pull downwards the terminal joints of the toes, and thus to fully expose the claws. In order to keep their claws in good condition, most cats—from the tiger downwards to the domestic cat—are in the habit of drawing them down the bark of trees, whereby they are rendered sharp and clean.

All the species of cats walk solely upon their toes, and are hence termed digitigrade: the hinder part of the foot being entirely raised from the ground to form a continuation of the leg. This mode of progression indicates a higher specialisation than the so-called plantigrade mode of walking, in which, as exemplified by the bears, the whole of the sole of the foot is applied to the ground. Formerly the distinction between digitigrade and plantigrade Carnivores was regarded as an important one in classification, but it is now known that nearly allied groups vary greatly in this respect, and that the character is a purely adaptive one. It has been already mentioned that the fore-feet of the cats are furnished with five toes. The innermost toe, corresponding to the human thumb, is, however, placed at a much higher level than the other four toes, and is consequently of no use in walking. The missing toe in the hind-foot corresponds to the human great toe. The stealthy walk characteristic of all the cats is due to the soft cushions, or pads, on the under-surface of the feet: each toe having a separate pad, behind which is a large pad occupying the middle of the sole of the foot. The fore-foot is thus furnished with six, and the hind-foot with five foot-pads. There is, however, on the fore-limb an additional pad on the outer side of the palmar aspect of the metacarpus. The impression, or *spur*, of a cat's foot always shows the form and number of the pads, and it should be particularly noticed that in such impressions there is no mark of the claws, which in walking are completely retracted. This affords a ready means of distinguishing between the track of a cat and a dog.

In order to enable them to lick off the meat from the bones, and perhaps also to aid in cleaning their beautiful fur, the tongues of all the cats are furnished with a number of flat processes, or papillæ, which are inclined backwards, and enable the tongue to act as a most effective rasp. In this respect cats again differ very markedly from dogs, in which the tongue is quite smooth; and it is probable that this difference may be accounted for by the fact that the teeth of the dogs are adapted for cracking and breaking bones, which are then swallowed; while those of the cats are not suited for this purpose, and the bones of their prey are consequently licked clean and left.

The fur of most members of the cat tribe is usually short, and of even length over the entire body; but the male lion is an exception in this respect, owing to the development of the large masses of long hair on the neck and shoulders. Such species as dwell in cold climates, like the ounce, have, however, much longer fur;

and it is noteworthy that when a species, like the tiger, inhabits both hot and cold regions, the length of the fur varies according to the climate.

Very characteristic of all the cats are the long bristle-like hairs, commonly known as "whiskers," but technically designated "vibrissæ," fringing the muzzle. These hairs are provided with special nerves, and act as delicate organs of perception to aid the animals in finding their way, and detecting objects during their nocturnal wanderings. In correlation with these nocturnal habits the eyes of the cats are large and full, and their "pupils" can be altered largely in size by the contraction or expansion of the iris, according to the amount of light they have to receive. In most of these animals the ears are short and rounded at the tips, but in the lynxes, and some allied species, they are elongated by the addition of pencils of long hairs to their tips. The tail in the majority of cats is long, cylindrical, and capable of peculiar snake-like moments: these movements being brought into play when the animals are excited or in pursuit of their prey. In some of the smaller typical cats, and in all the lynxes, the tail is, however, relatively short; while in the lion it is furnished with a large brush of hairs at the tip.

The usual coloration of the members of the cat tribe takes the form of dark spots or stripes on a lighter ground: the ground-colour generally varying from shades of grey through tawny to yellowish or orange. The spots may be either simple, or in the form of rings or rosettes enclosing an area of darker tint than the general ground-colour of the fur. From these ringed spots there is a gradual transition, as is well displayed in the marbled tiger-cat, to stripes, which are generally more or less vertical, and assume the most regular development in the tiger. In a few species, however, such as the lion and the puma, the entire coloration is tawny; but even then traces of spots may often be detected in certain lights, while the young are invariably spotted. From this it may be inferred that the uniform tawny coloration of such species is an acquired character—probably originally adapted to the desert-haunting habits of the species in which it occurs—and that all the cats were primitively either spotted or striped. A black colour among the wild members of the family is of comparatively rare occurrence, but it is met with among the leopards, and in certain other species.

In point of size, the members of the cat tribe present a greater degree of variation than is found in any other family of Carnivores: the larger species, like the tiger and lion, being only equalled in bulk by some of the bears, while the smallest member of the family—the rusty-spotted cat of India—is inferior in dimensions to the common domestic cat.

The total number of living species of the genus *Felis* may probably be reckoned at or about forty-one; and these have a distribution in space nearly coextensive with that of the entire order of Carnivores. They do not, however, extend so far northwards as do the bears and the dog family: and they are totally unknown in the Island of Madagascar. The greater number of species—more especially those of large size—are found chiefly in the tropical and subtropical regions of the globe; but the evidence of geology proves that the geographical range of some of these species was much more extensive at an earlier period than is the case at the present time. In respect of diet, the cats are purely carnivorous, and although when pressed by hunger some of them are known to eat the flesh of any dead animals they may

come across, as a normal rule they kill their own prey. This is always effected by cautious stalking, followed by a sudden final rush: and, although it is said that two or more lions will occasionally combine to drive game in a given direction, when it can be seized by another member of the party, the cats almost invariably pursue their prey alone. The general antipathy of the cat tribe to water is proverbial, but in the swampy sandarbans of Lower Bengal, the tiger has often been observed swimming from one marshy island to another: and the fishing cat of India largely subsists on fresh-water fish captured by itself.

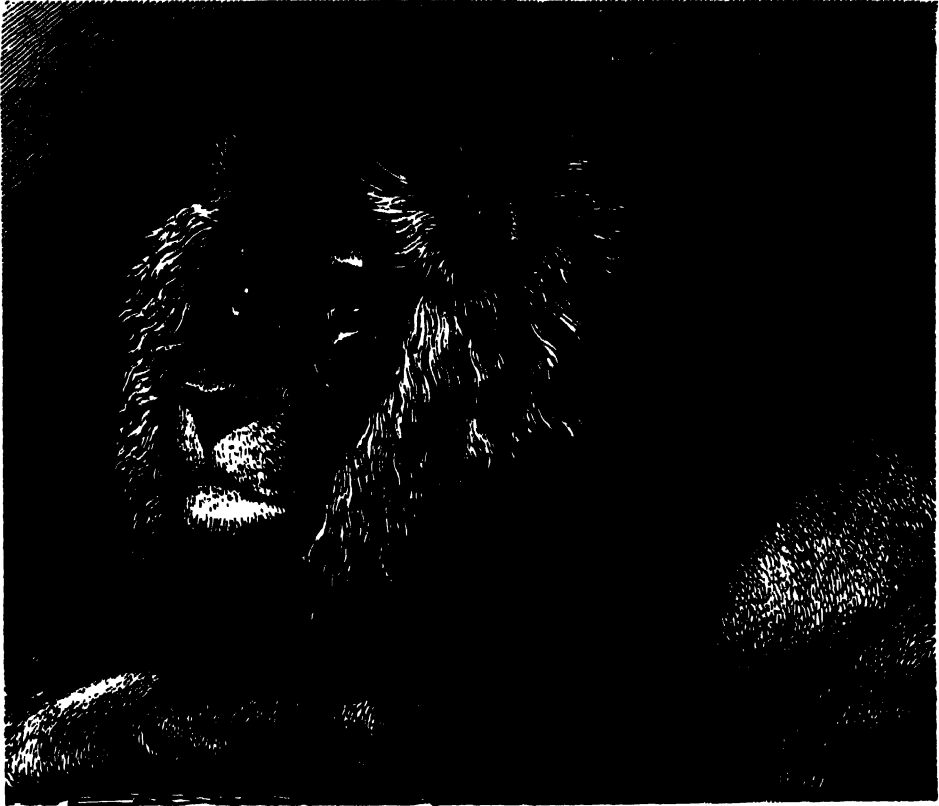
THE LION (*Felis leo*).

Till well on in the present century the title of "King of Beasts" was almost universally bestowed upon the lion by writers on natural history, on account of its generally majestic appearance, and the assumed nobility and fierceness of its character. Of late years, however, there has been a strong tendency on the part of those who have had the best opportunities of observing the animal in its native haunts, to depose the lion from the proud position it had so long occupied. The reasons for this change of view appear to be that when rousing abroad by daylight the lion, as Mr. F. C. Selous, the well-known African hunter, informs us, does not carry his head so high up as he ought to do in order to be entitled to the epithet majestic: while his disposition, instead of being noble and fearless, is considered by Livingstone and other writers to be more correctly described as cowardly and mean. Although it is impossible to doubt the accuracy of such observations as to its true character, yet the magnificent proportions of the animal, coupled with the splendid mane decorating the head and chest of the males, render the lion by far the most striking in appearance of the whole of the Cat tribe, and, indeed, of all the Carnivores.

In common with the other large cats of the Old World, the lion has the pupil of the eye circular: but it is at once distinguished from all the other members of the family by the long hair growing on the head, neck, and shoulders of the males to form the flowing mane. This mane varies considerably in size and colour in different individuals, but, contrary to what has often been stated, is present in Indian as well as in African lions. Frequently, although by no means invariably, the long hair of the mane is continued as a fringe down the middle line of the belly. Another distinctive characteristic of the male lion is the brush of long hair at the tip of the tail. In the middle of this brush of hair, at the very extremity of the tail, is a small horny appendage surrounded by a tuft. Much writing has been devoted as to the use of this so-called "thorn" in the lion's tail; one old story being that it was employed to rouse the animal to fury when the tail was lashed against the flanks.

The hair on the remainder of the body of the male lion, and on the whole of both the head and body in the female, is short and close. In the adults of both sexes the colour of the body-hair is the well-known yellowish-brown, or tawny, but the tint varies in intensity in different individuals. The long hair of the male's mane may vary from tawny to a blackish-brown. Young lion-cubs are marked with transverse dark stripes running down the sides of the body, and likewise by

a single stripe of similar tint along the middle of the back. In certain lights more or less faintly marked spots may be observed in many lions nearly or quite up to the period of maturity; these markings, as a rule, being more conspicuous in females than in males. The mane of the male does not make its appearance till the animal is about three years of age, and continues to grow until the age of about six years. Although the full length of the period of a lion's life does not appear known, it has been ascertained that they will live to thirty, and it is said even till forty years.



THE CAPE MANED LION.

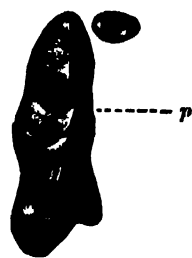
Owing to the circumstance that the measurements of lions are frequently taken from skins, exaggerated notions of the length attained by large males have obtained currency. Mr. Blanford states that a male—presumably an Indian specimen—measured 8 feet 10 inches from the tip of the muzzle to the tip of the tail: 2 feet 11 inches of this being occupied by the tail alone. Mr. Selous, writing of South African lions, observes that “the following are the lengths of the pegged-out skins of six full-grown males shot by myself, and carefully measured with a tape-line:—viz., 10 feet 3 inches, 10 feet 6 inches, 10 feet 9 inches, 10 feet 10 inches, 9 feet 7 inches, and 11 feet 1 inch. These are the lengths of the skins after being pegged out and stretched out to a certain extent. However, after having flayed it, I

carefully measured the naked carcase of the largest lion. From the top of the front teeth to the end of the tail it measured 9 feet 7 inches, laying the tape along the curves of the body, and as all the gristle and meat of the nose had been cut away with the skin, and at least an inch must have been lost with the tuft at the end of the tail, I think it would have measured all but 10 feet before it was skinned, even without making any allowance for the mane." Although Cornwallis Harris gave 10 feet 6 inches as the length of a large lion, Mr. Selous' estimate may be provisionally taken as representing the full size of the African type. Females are generally about 1 foot shorter than males. There is a dearth of information as to the height of a full-grown lion at the shoulder; but Mr. Blanford tells us that one measuring 8 feet 9½ inches in length, had a height of 3 feet 6 inches. A fine menagerie lion recently measured had a total length of 10 feet, of which the tail occupied 3 feet 2 inches.

Still more imperfect is the information relating to the weight of lions. Mr. Selous states that an African lion in poor condition shot in 1877 weighed 376 lbs.; but a fine, well-nourished example killed later on weighed 500 lbs. This weight is, however, exceeded by a male shot in the Orange Free State in 1865, which on good evidence is reported to have weighed over 583 lbs. The menagerie specimen, of which the dimensions are given above, weighed 434 lbs. Sir Samuel Baker is of opinion that a lion would weigh more than a tiger of the same approximate dimensions; but against this may be set the opinion of Mr. Blanford, who considers that a tiger, although standing lower than a lion, is heavier in the body and more powerful.

Before entering upon the consideration of the geographical distribution and habits of the lion, it may be well to point out how the skull of a lion may be readily distinguished from that of a tiger. In a lion's skull the so-called nasal bones, or those forming the roof of the cavity of the nose, have their superior termination on the forehead situated in the same transverse line as the terminations of the upper jawbones or maxilla. In the skull of a tiger, on the other hand, the upper extremities of the nasal bones extend considerably higher up on the forehead than do those of the upper jawbones. The skull of a lion may also be distinguished from that of a tiger by the much smaller size of the tubercle on the inner side of the upper flesh-tooth. Thus, whereas in the tiger this tubercle is but little smaller than in the corresponding tooth of the hyæna, figured on p. 353, in the lion it more nearly approaches the condition obtaining in the tooth of an extinct cat, represented in the accompanying figure, although it extends nearer to the front edge of the tooth. The skull of an adult male lion may measure as much as 13 inches in extreme length, with a breadth across the widest part of the cheek-bones of 9½ inches.

The present range of the lion includes the whole continent of Africa, from the Cape Colony to Abyssinia and Algeria, although in many of the more civilised districts the animal is now greatly reduced in numbers, or even completely exterminated. In Asia it is found through



THE LEFT UPPER FLESH-TOOTH (p) AND MOLAR (m) OF AN EXTINCT SABRE-TOOTHED TIGER.

The projection on the side of the lower part of the figure is the inner tubercle of the flesh-tooth.

Mesopotamia and South Persia to the north-western districts of India, being, however, now on the verge of extinction in the latter country. Formerly, even within historic times, the lion had a much more extensive geographical range, extending westwards into Syria and Arabia, and ranging over a considerable portion of South-Eastern Europe, such as Roumania and Greece. This, however, by no means limits the original extent of its range, for bones and teeth found in the caverns and superficial deposits of Western Europe prove that lions, which appear specifically undistinguishable from the existing form, once roamed over Germany, France, Italy, Spain, and the British Isles. The ancient prehistoric lions of Western Europe were in all probability exterminated by the cold of the glacial period; but the destruction of those infesting Eastern Europe and parts of Western Asia during the historic epoch was probably effected, at least to a considerable extent, by human agency.

In South Africa lions are now scarce in the districts to the southward of the Orange River, but are locally abundant in the regions farther north, such as Mashonaland. Although it is quite probable that its range may once have embraced the countries of Afghanistan and Baluchistan, the lion is now quite unknown in Asia to the northward of India. Writing some years ago of the habitats of the lion in Western Asia, Canon Tristram observes that "the Arabs say it is found in Arabia; but of this we have at least no evidence. Occasionally it crosses the Euphrates, and a few years ago a lion's carcase was brought into Damascus. Between the Lower Tigris and Euphrates they still abound. Mr. Layard saw them frequently, and during his excavations in the neighbourhood of Babylon, found fresh traces of their footsteps almost daily among the ruins. It extends also far higher up, to the jungle of the Khabour, or Chebar, on the upper Tigris, above Mosul and Nineveh (the ancient Chebar), where Layard mentions an Arab being attacked by one, and escaping with the loss of his mare."

The late Sir O. B. St. John, as quoted by Mr. Blanford, observes that "lions, which are very numerous in the reedy swamps bordering the Tigris and Euphrates, are found also in the plains of Susiana, the modern Khuzistan, and extend into the mountain country south of Shiraz as far east as longitude 53°. I have no accurate information of their northern limits, but Captain Pierson, who spent many years in the country between Tehran and Baghdad, tells me that he never heard of lions in the oak forest west of Karmanshah. It is the acorns of this same oak forest which feed the wild pigs whose presence tempts the lion into the mountains of Fars. . . . The little Valley of Dashtiarjan, thirty-five miles west of Shiraz, is notorious for the number of lions found in its vicinity. Part of the valley is occupied by a fresh-water lake, on the edges of which are extensive beds of reeds; the surrounding hills, which rise some four thousand feet above the valley, itself six thousand five hundred feet above the sea, are covered with oak forest, or with pretty thick brushwood of hawthorn, wild pear, and other bushes, and contain very extensive vineyards. Dashtiarjan is thus a perfect paradise for swine, and they increase and multiply accordingly, so that the lions have plenty to eat, varying the monotony of constant pork with an occasional ibex, or with a calf from the herds which graze in the valley. Every year some four or five lions are killed in Dashtiarjan or the neighbourhood, and a few cubs brought into Shiraz for sale."

With regard to the lion in India, Mr. Blanford states that "there are probably a few still living in the wild tract known as the Gir, in Kattywar, and a few more on the wildest parts of Rajputana, especially southern Jodhpur, in Oodeypur, and around Mount Abu. About twenty years ago lions were common near Mount Abu, several were shot near Gwalior, Gooma, and Kota, and a few still existed near Lalotpur, between Saugor and Jhansi. One is said to have been killed near Gooma in 1873. In 1864 one was killed near Sheorajpur, twenty-five miles west of Allahabad; and when the railway was being made from Allahabad to Jabalpur in 1866, a fine lion, with a good mane, was shot by two of the engineers, near the eightieth milestone from Allahabad. About 1830, lions were common about Ahmedabad. Several years previously, in the early part of the century, lions were found in Hurriana to the northward, and in Khandesh to the south, in many places in Rajputana (one was shot in 1810, within forty miles of Kot Deji, in Sind), and eastward as far as Rewah and Palamow. It is probable that this animal was formerly generally distributed in North-Western and Central India." A few years will probably witness the extinction of the lion throughout the peninsula. It is noteworthy that the lion, unlike the tiger, has never been known in the Malayan region, or, indeed, anywhere to the eastward of the Bay of Bengal.

For a long period it was considered that the Indian lion differed from its African relative by the total absence of the mane in the male, which was hence regarded as indicating a distinct species. Moreover, owing to the differences in the length and colour of the manes of African lions from different districts, it was likewise held that there were two or more species in Africa. It, however, has been definitely settled that such variations are not constant, and that there is but a single species. Although it may be that some adult specimens of the Indian lion are maneless, yet well-maned examples have been killed, while those which were stated to prove the existence of a maneless race are now known to have been immature individuals.

With regard to the variations of the African lion, Mr. Selous says that the Dutch hunters maintain the existence of from three to four distinct species, which they assert themselves to be capable of recognising. "For my part," adds Mr. Selous, "and judging from my own very limited experience of lions, I cannot see that there is any reason for supposing that more than one species exists, and as out of fifty male lion skins scarcely two will be found exactly alike in the colour and length of the mane, I think it would be as reasonable to suppose that there are twenty species as three. The fact is that between the animal with hardly a vestige of a mane, and the far handsomer but much less common beast, with a long flowing black mane, every possible intermediate variety may be found." It is then stated how the narrator on one occasion shot two old male lions, which he found lying together under the same bush, both of which agreed as near as possible in size, but while the one was full-maned, with a very dark-coloured fur, the other was very yellow and had but little mane. Shortly after, Mr. Selous, with a brother sportsman, again met with a dark, full-maned lion in company with a nearly maneless light-coloured one. Of still more importance is the account by the same hunter of his killing a lioness with three unborn cubs, of which two were males and one a female. "Of the two male cubs," says Mr. Selous, "the one, owing

to the dark colour of the tips of the hair, was almost black, while the other was reddish-yellow. The skin of the female cub was also of a light colour. Now I firmly believe that the two male cubs would have grown up, the one into a dark-skinned, black-maned lion, the other into a yellow lion, with but little mane; and further than this, I believe that the two pairs of males I have mentioned above were cubs of the same litters, and have been hunting in couples since their cubhood." These observations, which have been supplemented by others made on captive specimens, may be considered to definitely settle the question as to the specific unity of all African lions.

In spite, however, of the impossibility of specifically distinguishing between lions of different coloration, or between those inhabiting different regions of the country, it seems quite probable that the lions of one district may differ to a certain extent in some respects from those of another. Thus it seems pretty well ascertained that the lions from the Cape and Algeria have, collectively, larger and finer manes than those from other districts. Moreover, Gordon Cumming states that the manes and coats of lions inhabiting open, treeless districts, like the great Kalahari desert of South Africa, are fuller and handsomer than in those inhabiting forest districts. It has hence been considered that the manes of forest-dwelling lions are reduced in thickness by being torn by thorns and bushes. This theory is, however, considered untenable by Mr. Selous, who states that the lions of the open plateaux of Matabeleland and Mashonaland, where scarcely a thorn-bush is to be seen, exhibit every degree of variation in regard to the length and colour of their manes, and that a similar variation holds good for the Tati country, which is thickly covered with thorn-jungle. The variation in the length of the mane seems, therefore, at present not accounted for.

Before leaving this subject, it may be mentioned that, according to the experiences of the hunter from whom we have already so largely quoted, that wild lions—at least in the districts over which he shot—never have such long and heavy manes or such good coats as the majority of those met with in European menageries. Moreover, while all the wild lions with good manes, which came under the notice of Mr. Selous, had a small tuft of hair on the elbow and another in the armpit, none were seen with the fringe of long hair along the middle of the under-surface of the body, which is so universally present in maned menagerie lions. "I do not say," observes Mr. Selous, "that cases do not occur of wild lions becoming equally hairy: but they must be very rare, otherwise I should have met with some amongst the large number of skins I have seen. The coat of the wild lion is very short and close, whilst that of lions kept in this country becomes very much longer, and usually of a redder colour than the pale yellow or silvery-grey hue of the wild animal. I could pick out the skin of a menagerie lion from amongst a hundred wild ones. Climate and regular feeding must, I think, have a good deal to do with the luxuriant growth of mane invariably to be observed in lions in confinement." As our pictures and figures of lions are almost invariably taken from such captive specimens, it is obvious that an exaggerated idea of the size and beauty of the mane is commonly current.

Habits.

The literature relating to the habits of lions is so extensive that the great difficulty an author has to contend with is in determining

what to select and what to reject. Moreover, it will be found that in comparing the accounts given by different observers there is considerable diversity between them in regard to certain points. This difference, as observed by the Hon. W. H. Drummond, is doubtless due, to a certain extent, to differences in the habits of lions from different districts: but to this must be added the "personal equation" of the various observers.

With regard to the habits of lions, it is probable from the uniformly tawny colour of these animals that they were primitively inhabitants of more or less completely desert or sandy regions, although they are now by no means restricted to such localities. In Africa, as Gordon Cumming relates, lions were formerly



THE LION AT A POOL.

abundant in the sandy wastes of the great Kalahari Desert; while they are now, according to Mr. Selous, equally plentiful in the high open country of Mashonaland, among the rough broken hills through which the tributaries of the Zambesi make their way to the main river, in the dense thorn-jungles lying to the west of the Gwai River, or in the marshes of the Linyanti River. Then again, whereas the Indian lion was formerly abundant in the sandy plains of Rajputana, the favourite haunts of the animal in Mesopotamia are, as we have seen, in the swampy lowlands of the Tigris and Euphrates valleys.

Like most of the larger cats, lions are essentially nocturnal in their habits, and they are thus frequently only met with by chance in districts where, from the abundance of their tracks and from their nocturnal roarings, they are known to be plentiful. During the daytime they are accustomed to lie asleep in thick beds of reeds, where such are to be found, or, in drier districts, among thickets and bushes.

"The most likely places in the bush country in which to find lions," observes Mr. Drummond, "as far as my experience goes, are the rekabee thorns, the dense evergreens which line the rivers, and, during summer, the reeds on the margins of lagoons or streams, while in the open flats any patch of reeds or tall grass suffices to conceal them. The best chances for killing them are obtained in the first-mentioned spots, as you often come across them asleep when you are stealing about after game." From these and similar haunts, the lion issues forth at sundown to commence his nightly prowls: dark and stormy nights, according to Gordon Cumming, being those on which he is most active, while he is more cautious during bright moonlight nights, especially as regards his visits to the drinking-places.

Unlike most of his congeners, the lion is not a climber, and this general inability to ascend trees has saved the lives of many sportsmen and travellers, although not unfrequently at the cost of a long and thirsty waiting.

Mr. Blanford, who has had the opportunity of observing both lions and tigers in their native haunts, is of opinion that the former are bolder than the latter, while they are certainly far more noisy. When relating the results of his experiences during the Abyssinian Expedition, he observes that "the first peculiarity that struck me in the African lions was their noisiness. I have constantly been for months together in countries in India abounding in tigers without hearing their cry. Indeed, it is by no means a common sound in any Indian forest. Leopards, I should say, are much more frequently heard than tigers. The cry of the two animals, commonly known as roaring, though it is utterly different from the harsh growl of anger to which the term might most appropriately be applied, is very similar, and consists of several deep notes uttered rather quickly one after the other, and repeated at longer and shorter intervals."

Very different impressions appear to be produced on different persons by the lion's roar, some listeners appearing to regard it as a rather commonplace and by no means awe-inspiring sound, while others, and we believe the majority, speak of it in far different terms. Such differences of impression must, it is obvious, be largely due to personal disposition.

Perhaps the lowest estimation of the lion's roar is that of Livingstone. He writes that "it is calculated to inspire fear when heard in a pitchy dark night amidst the tremendous peals of an African thunderstorm, and the vivid flashes of lightning which leave on the eye the impression of stone-blindness, while the rain pouring down extinguishes the fire, and there is neither the protection of a tree nor a chance that your gun will go off. But when anyone is snug in a house or a waggon, the roar of the lion inspires no awe. A European cannot distinguish between the note of a lion and that of an ostrich. In general the voice of the former seems to come deeper from the chest: but to this day I can only pronounce with certainty from which of the two it proceeds, by knowing that the ostrich roars by day and the lion by night. The natives assert that they can detect a difference at the beginning of the sound."

A recent writer in *Land and Water*, who is fully impressed with the grandeur of the lion's roar, is by no means disposed to admit the justness of its comparison to the voice of the ostrich. He observes that when a lion is "roaring loudly in concert with others at a short distance off, the sound is grand and awe-inspiring in the

extreme; in fact, I have never heard anything of a similar nature that can compare with it, for it is no exaggeration to say that the ground actually trembles with the volume of sound. I say this unhesitatingly, for all that many people would have us believe to the contrary, maintaining that there is nothing in it, and endeavouring to compare it to the 'booming' of the cock ostrich. At a great distance, and therefore, when heard indistinctly, the low, sullen roaring of a single lion has certainly much resemblance to the sound emitted by the ostrich during the pairing-season: but persuade either the lion or the ostrich to come nearer, and one might then as well try to compare the rumbling of cart wheels over a wooden bridge with the incessant roll of thunder among mountains. But a lion makes other sounds far more disconcerting—because usually only heard at close quarters—than that to which it gives vent when, in company with others, it has killed a head of game, or is retiring to its lair, full fed. There is the constant low growling of the lion crouching in cover, uncertain whether to fight or to fly, as, with flattened ears and nervously twitching tail, he studies the situation, hoping by his attitude to warn off the disturber of his solitude. There is the angry snarl of the lion disturbed at his meals, when his appetite is not yet satisfied, and when one has come upon him so suddenly as to give him no time to clear off; and, worse than all, the short, coughing grunts which often accompany a charge, and which startle the intruder in his domains as he bounds away. All these sounds are by no means musical, and, whether heard by day or by night, are well calculated to try the nerves." Similar testimony as to the impressiveness of the lion's roar is given by Gordon Cumming, who describes it as consisting at certain times of five or six repetitions of a low, deep moaning, ending off with a faint and scarcely audible sigh, while at others it takes the form of loud, deep-toned, solemn roars, quickly repeated, and increasing in intensity till the third or fourth, after which it gradually dies away in a succession of low muffled growlings, like the roll of distant thunder. Then, again, the veteran hunter, Sir Samuel Baker, gives his impressions in the following words:—"There is nothing so beautiful or enjoyable to my ears as the roar of a lion on a still night, when everything is calm, and no sound disturbs the solitude except the awe-inspiring notes, like the rumble of distant thunder, as they die away into the deepest bass. The first few notes somewhat resemble the bellow of a bull; these are repeated in slow succession four or five times, after which the voice is sunk into a lower key, and a number of quick short roars are at length followed by rapid coughing notes, so deep and powerful that they seem to vibrate through the earth."

This vibrating and reverberating sound alluded to in the last sentence is intensified by the habit lions often have of putting their mouths close to the ground while roaring: Livingstone mentioning an instance where a lion stood for hours roaring near his camp, and making the sound reverberate in this manner.

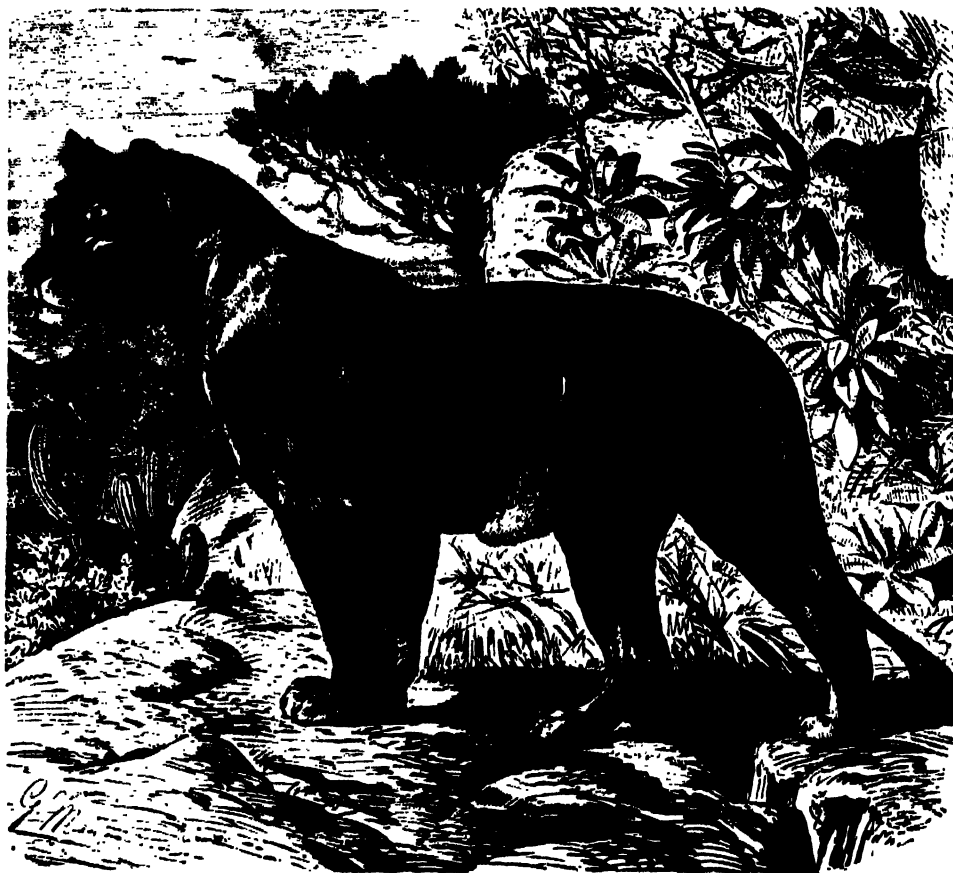
The intensity and grandeur of the sound must, however, be largely increased when, as is not unfrequently the case, a party of lions are heard roaring in concert; and the din reaches its height when two or three troops of lions approach a watering-place at the same time. On such occasions, says Gordon Cumming, "every member of each troop sounds a bold roar of defiance at the opposite parties; and when one roars, all roar together, and each seems to vie with his comrades in the intensity and power of his voice."

As a rule, lions commence to roar with the falling shades of evening, and continue with longer or shorter intervals throughout the night; but Gordon Cumming states that in secluded and undisturbed districts he has frequently heard the roaring sustained as late as 9 or 10 o'clock in the morning on bright and sunny days. During cloudy and rainy weather they will however roar, although in a lower tone, throughout the day.

Although in some districts lions are commonly met either alone, or in pairs of males and females, this does not seem to be generally the case in the interior of South Africa, where, according to Mr. Selous, it is more usual to meet with four or five lions consorting together, while parties of from ten to twelve are by no means rare. Such a party of twelve would, in the experience of the same observer, probably comprise about two adult males, three or four full-grown lionesses, and half a dozen large cubs, which, except for their somewhat slighter build, might easily be mistaken for mature females. On one occasion Mr. Selous mentions that he came across a party consisting of a lion, three full-grown lionesses, and three small cubs; and he adds that if each of these females had possessed a pair of large cubs, such an assemblage would have been rightly termed a party of ten lions. It was probably such a party, although comprising more adult males, that Lord Randolph Churchill encountered during his recent journey in Mashonaland, when in company with his hunter Lee. "We were riding along," writes his lordship in his *Letters from Mashonaland*, "through a small open glade covered with high grass, Lee a few yards ahead of me, when I suddenly saw him turn round, cry out something to me, and point with his finger ahead. I looked, and saw lolloping along through and over the grass, about forty yards off, a yellow animal about as big as a small bullock. It flashed across me that it was a lion—the last thing in the world that I was thinking of. I was going to dismount and take aim, for I was not frightened at the idea of firing at a retreating lion, but Lee called out in succession five or six times, 'Look, look!' at the same time pointing with his finger in different directions in front. I saw, to my astonishment, and rather to my dismay, that the glade appeared to be alive with lions. There they were, trooping and trotting along ahead of us like a lot of enormous dogs—great yellow objects, offering such a sight as I had never dreamed of. Lee turned to me and said, 'What will you do?' I said, 'I suppose we must go after them,' thinking all the time that I was making a very foolish answer. This I am the more convinced of now, for Lee told me afterwards that many old hunters in South Africa will turn away from such a troop of lions as we had before us. We trotted on after them a short distance to where the grass was more open, the lions trotting along ahead of us in the most composed and leisurely fashion, very different from the galloping off of a surprised and startled antelope." Lord Randolph Churchill himself counted no less than seven lions, while his hunter believed that there were several more in the party.

When a male lion has selected a female partner the union very generally lasts for the greater portion or the entire lives of the pair. From the evidence of specimens kept in captivity it is known that from two to six cubs may be produced at a birth, at least in the captive condition. It is stated, however, that in India wild lionesses do not produce more than two or three cubs at a birth; and Mr. Selous is of opinion that three is the usual number in South Africa, where

many cubs appear to die while still very young. Lions breed freely in captivity, but not so readily in some menageries as in others. Thus, whereas in the London Zoological Gardens the number of cubs bred and reared is comparatively small, in those at Dublin it is very large; and many of the lions exhibited in various menageries have been reared at the latter establishment. It is a curious fact that lion cubs are born with their eyes fully open.



THE MANELESS LION FROM SENEGAL ($\frac{1}{2}$ nat. size).

When caught young, lions are easily tamed, and the whole disposition of the animal in captivity is much more gentle than is that of the tiger.

That adult lions will combine to attack large animals that they would find it difficult or impossible to overcome unaided, is now well ascertained. The best known instance is one observed by Major Varlon and Mr. Oswell in South Africa, when three full-grown males united their efforts in endeavouring to pull down an old buffalo. When first observed the four animals were engaged in a terrific combat, the final issue of which might have been doubtful, had it not been terminated by the sudden death of the buffalo from the effects of a bullet-wound it had previously received from the rifle of one of the witnesses. No sooner, however, did

their prey succumb, than the three lions commenced to quarrel among themselves; one, reared to half its height, resting its paws upon the middle of the carcase, while the other two respectively placed themselves at the head and tail, and growled forth defiance at the one in the middle. What might have been the result of the dispute can only be imagined, as two of the lions were shot, while the third, thinking discretion the better part of valour, prudently retired.

Another instance of a somewhat similar encounter is related by Sir Samuel Baker, who states that a Bavarian hunter in his employ, named Johann Schmidt, was on one occasion wandering along the bank of the Royan River in Abyssinia, when his attention was attracted by the sounds of a scuffle taking place at a water-hole. "The dust was flying high in the air, and as he approached the spot, within the yellow surface of the river's bed, he saw a cloud of sand, in the centre of which was the large body and long neck of a bull giraffe struggling against the attack of two lions. One of these was fastened upon its throat, while the other was mounted upon its hind-quarters, where it was holding on with teeth and claws. . . . The giraffe had no chance, and after a sharp struggle, before the well-concealed spectator, it was pulled down, and both lions commenced to growl over their contested prey."

Although in both the foregoing instances the lions, after securing their prey, commenced to quarrel among themselves, it does not appear that such quarrels always occur in similar circumstances, since Gordon Cumming relates how that he once saw no less than six lions feeding peaceably upon the carcase of a rhinoceros.

From this part of our subject we are naturally led on to the consideration of the ordinary food of lions, and the manner in which they attack the larger animals upon which they prey. It has been already mentioned that in the oak forests of Persia the staple food of the lions is formed by the wild pigs which frequent these woods. In India Mr. Blanford states that lions usually feed on deer, antelope, wild pigs, cattle, horses, donkeys, and camels; and that formerly a large number of the latter were destroyed by them. In Africa lions appear to prey largely upon antelopes, zebras, quaggas, buffaloes, and giraffes. Mr. Drummond states that on the many occasions on which he has seen lions hunting by daylight, he cannot recall one when they were not in pursuit of buffaloes, and he has known herds of those animals which he had been hunting during the day scattered and dispersed by lions at night. On the other hand, Mr. Drummond would not commit himself to the statement that buffalo-meat forms the staple food of the South African lion. "Were a zebra, a fat rhinoceros, and a fat buffalo to be killed and left out, it is probable that they would be eaten in the order I have named. Soft succulent fat is what the lion probably considers most toothsome, and zebras supply this in a higher degree than any other animal, save the rhinoceros and the hippopotamus, neither of which he is able to kill; but on the other hand, the zebra . . . confines himself to the open, as far as possible, never approaches within springing distance of a thicket, and rarely, unless when going to water, gives the lion a chance. Buffaloes, on the other hand, are nearly always in and close to cover, presenting continual opportunities for a successful stalk: and though the danger in attacking them is much greater, as is proved by the no means rare instances of lions being maimed, and even killed in such contests, yet for the above reason they form their chief food."

It must not, however, be supposed that lions by any means restrict themselves to the flesh of animals which have fallen to their own attacks. The writer last quoted mentions their partiality for the flesh of rhinoceroses, which they are unable to kill themselves, and states that as many as eight or ten have been seen tearing at once at the flesh of one of those animals that had been shot by a hunter of his own. This is confirmed by the statement of Gordon Cumming already mentioned.

In addition to eating the flesh of animals recently killed, lions will also prey upon carcases in an advanced state of decomposition. This fact was stated long ago by Gordon Cumming, and is fully supported by the observations of Mr. Selous. The latter writer states that when elephants have been shot, "lions will prey upon the stinking carcases as they lie festering in the rays of a tropical sun, and at last become a seething mass of maggots, returning night after night to the feast, until no more meat is left. This occurs in parts of the country abounding in game, where it would give a party of lions but little trouble or exertion to catch a zebra, buffalo, or antelope, and procure themselves a meal of fresh meat. In the same way, no matter how plentiful game may be, lions will almost invariably feast upon any dead animal left by the hunter, from a buffalo to a steinbuck, that they may happen to come across."

Near villages, when lions grow too old to be able to take game for themselves, Livingstone states that they will take to killing goats; while women or children who happen to come in their way at night also become victims. On the other hand, when far away from human habitations, such decrepit lions are stated by the same writer to catch mice and other small Rodents, and will even at times eat grass, although this may be taken medicinally.

That such lions, which have become too feeble to prey upon game, would naturally develop into "man-eaters," if they were permitted to live, appears highly probable. Mr. Selous believes, however, that the absence of man-eating lions in those parts of Africa with which he is acquainted is due "to the superior boldness of the African natives over those of India, for even amongst the least martial tribes of South Africa, if two or three people are killed by a lion, the population of the surrounding country is roused, and, a party being formed, the lion is usually surrounded and stabbed to death with assegais; whilst, amongst such warlike tribes as the Matabele, if a lion only kills an ox, or even a goat, its fate is usually sealed, or, even if not killed, it gets such a scare that it is glad to quit the district. Such a thing as a man-eater, or even an habitual cattle-slayer, would never be tolerated for an instant."

According, however, to Mr. Drummond, whose shooting experiences were confined to Eastern South Africa, in the districts of Zululand, Tongaland, and Swaziland, man-eating lions are to be met with in some regions. And this writer relates how he became an accessory to the death of two such man-eaters, one of which had well-nigh depopulated a district, having killed between thirty and forty individuals; while the second, although dwelling in an uninhabited country full of game, had become notorious for its attacks upon the camps of the hunters. The former, indeed, appeared to be an animal in the full enjoyment of bodily strength, as it is said to have habitually leaped over the high fences which surround the Zulu villages.

With regard to the method in which lions kill and carry off the larger animals upon which they prey, it may be observed, in the first place, that there is some doubt whether death is effected by dislocating the neck of the victim, as is always done by tigers. Mr. Blanford states that in a cow killed by a lion in Abyssinia the vertebræ of the neck were not dislocated; and that he also saw a lioness hold a camel for several minutes without attempting to break its neck. Mr. Selous is of opinion that lions have not one universal way of killing their prey, but they vary it according to circumstances. Thus he relates how he has seen a horse, a young elephant, and two antelopes killed by a bite in the throat; while he has also known instances of horses and zebras being killed by a bite on the back of the neck behind the head. Buffaloes, he believes, are sometimes killed by a dislocation of the neck, which is effected by "the lion springing on to their shoulders, and then seizing their noses with one paw, giving the neck a sudden wrench."

It was formerly a prevalent notion that lions were in the habit of carrying off the carcasses of large animals, like oxen and buffaloes, by throwing them over their back and walking bodily away with them. All recent observers are, however, agreed that this is by no means a correct statement, and that their invariable practice is to transport such carcasses by dragging them along the ground. Mr. Selous states that in this manner lions carry off not only the bodies of the larger animals, like buffaloes, but also those of the smaller antelopes: and he adds that a South African lion would, in his opinion, be quite incapable of lifting a buffalo from the ground, much less of leaping over a fence with it, as the lion of North Africa has been alleged to do. In referring to an instance of this nature when a North African lion was reported to have leaped over the thorn fence which formed a protection to a camp, and, after seizing a full-grown ox, bounded back with its victim, Sir Samuel Baker writes as follows:—"In the confusion of a night attack the scare is stupendous, and no person would be able to declare that he actually saw the lion jump the fence with the bullock in its grip. It might appear to do this, but the ox would struggle violently, and in this struggle it would most probably burst through the fence, and subsequently be dragged away by the lion. . . . It is quite a mistake to suppose that a lion can carry a full-grown ox; it will partially lift the fore-quarter, and drag the carcass along the ground."

It is stated that the usual pace of a lion when undisturbed is a walk, but even then, from the length of his stride, he gets over the ground quicker than appears to be the case. When going more rapidly, Mr. Selous says that he has never seen a lion bound, but that they come along at a clumsy gallop, somewhat after the manner of a dog, getting over the ground very quickly.

In regard to the ferocity or otherwise of the lion's disposition, very conflicting statements will be found in the writings of different observers. Thus, whereas Livingstone states that nothing would lead him to attribute to the lion either the ferocious or noble character ascribed to it by others, Sir Samuel Baker is disposed to take a rather opposite view, observing that, although he does not consider the lion to be either so formidable or so ferocious as the tiger, yet there is no reason for despising an animal which has been respected from the most remote antiquity.

All writers appear, however, to be agreed that, as a general rule (although there are exceptions), a lion will not go out of his way to make an unprovoked

attack upon human beings, and that, in point of fact, he will rather shun a conflict when possible. "There is nearly always," writes Mr. Drummond, "some explanation of its behaviour when it acts otherwise: either the hunter has approached so near before being discovered that the animal is afraid to turn tail, and, urged by its very fears, makes a charge: or it may be half-famished, and having got hold of some prey, either of your killing or its own, will not quit it without a contest: or, if a lioness with cubs, will fight in defence of their supposed danger." Sir Samuel Baker's testimony is of a very similar character, when he mentions that the expert swordsmen of Central Africa have no dread of the lion when undisturbed by sportsmen, although they hold him in the highest respect when he becomes the object of chase. Again, in another passage, the same writer mentions that among the Hamran Arabs of the Sudan the lions, although numerous, are never regarded as dangerous.

That lions, especially when hungry, will, however, on occasion attack human beings,—on foot or when mounted,—there is abundant evidence. Livingstone relates the well-known instance of a hunter engaged in stalking a rhinoceros, when, on looking back, he was horrified to find that he himself was being stalked by a lion. Mr. Drummond also records an instance where a lion, driven by hunger, attacked him personally: and he believes that there are some lions which will always make unprovoked attacks. This view he supports by an account of an attack made upon three natives in Eastern Africa. The three natives in question were passing along the edge of a certain lagoon, "when, without further warning than a slight rustle, a lion sprang upon the foremost, crushing him to the ground. His terrified comrades, throwing away the chance of shooting the brute while it was still upon its first victim and its eyes probably closed, rushed to the nearest trees for safety, but, once there, feeling ashamed of their cowardly desertion of an old companion, they descended, and walking forward together were just on the point of firing, when, with a roar that almost deprived them of the power to run, the lion charged, caught the hindmost, and after shaking him for a second or two gave chase to the other, who, however, had profited by the time to remove himself, by a bare foot or so, out of reach of the spring the enraged animal gave as it saw that one had so far escaped. It then returned to its last victim, not yet dead, took him up in its mouth, dropped him, tossed him from paw to paw as a cat does a mouse, and at last, as if wearied by so much unaccustomed gentleness, it allowed its savage nature to gain the mastery, and with one crunch of its powerful jaw put him out of his pain." The sole survivor of this tragedy, after having been besieged for hours in a tree, during which he had a hairbreadth escape when descending to reach his gun, finally had the satisfaction of putting a bullet through the ribs of the lion.

With regard to the dangers of lion-hunting in Africa, which is mostly conducted on foot, those who have had the most experience, and are therefore the best entitled to speak with authority, are in accord as to their reality. Gordon Cumming says that lion-hunting, under any circumstances, must of necessity be a dangerous pursuit; but that it may be followed to a certain extent with comparative immunity from harm by those who have the necessary nerve and coolness, coupled with sufficient knowledge of the habits of the animals. Mr. Selous, writing in 1881,

when sixteen lions had fallen to his rifle, considers the lion a far more dangerous animal to encounter than any other creature in South Africa. It is true, indeed, that a much greater number of casualties occur from buffalo-shooting than in lion-hunting, but then, as Mr. Selous is careful to observe, for every lion that has of late years been "bagged" in the interior of South Africa, at least fifty buffaloes have been laid low. As a general rule, according to the same authority, the danger is reduced to a minimum when hunting with dogs, as the lion's attention is generally concentrated on his canine foes; but even then it sometimes happens that he will dash straight through them to attack the hunter. A mounted hunter, except when the movements of his horse are impeded by thick forest or by yielding sand, can generally escape when pursued, as, in the opinion of Mr. Selous, the pace of the average lion is not sufficient to enable him to overtake the average horse. "If, however, on foot," adds Mr. Selous, "and without dogs, though there is little danger in attacking lions in the first instance, yet to follow up a wounded one is very ticklish work, especially in long grass or thick cover, for there is probably no animal of its size in the world that can conceal itself behind so slight a screen, or rush upon its pursuer with such lightning-like rapidity."

Still more impressive are the words of Mr. Drummond, who says that "it should always be recollected, before meddling with lions, that if you do come to close quarters with them, death is the probable result. There are cases within my own knowledge," continues this writer, "where, single-handed and armed only with a spear, a native has succeeded in killing one that has sprung upon him, without receiving in return anything but trifling injuries; but these are only exceptions that prove the rule that when they strike they kill. . . . It is a grand sight to see one charge a native regiment sent out after it, as they sometimes are, springing over the heads of the first line right into the centre, flying about, knocking men down with every blow, until, a complete sieve of assegai wounds, it dies fighting."

Sir Samuel Baker follows suit in contrasting the dangers of the solitary hunter on foot engaged in lion-shooting in Africa, with tiger-shooting in India, either from elephants, or with a number of guns posted in secure positions.

Writing of his experiences in Somaliland, Mr. J. D. Inverarity observes that the lion tries to avoid man until wounded, and it is only in exceptional cases of there being young ones to guard, or from astonishment at seeing the hunter so close to them, that they charge when being tracked. They charge with the same coughing roar that a tiger does, and come at great speed close to the ground, not bounding in the air as they are represented in pictures. Their ears are pressed close to the head, giving them the comical appearance of being without ears. "So large an animal coming at full speed against you of course knocks you off your legs. The claws and teeth entering the flesh do not hurt so much as you would think. The only really painful part of the business is the squeeze given by the jaws on the bone. I felt none of the dreamy stupor Livingstone describes, but, on the contrary, felt as usual. I adopted the course of lying quite still, which, I believe, is the best thing one can do, as you are quite helpless with a heavy animal on you, and they are inclined to make grabs at everything that moves, and the fewer bites you can get off with the better." Stories of lion-hunting are legion, and if collected would form at least one goodly volume; we shall, however, refrain from quoting any, and



TIGRESS AND CUBS

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close our notice of what is, in our own opinion, the grandest of all Carnivores, with the following extract from Mr. Drummond's interesting book, upon which we have already drawn so largely. "Perhaps the most beautiful sight that I ever saw in connection with lions," writes Mr. Drummond, "was on a morning when I had gone out to hunt with one bearer at dawn. I had got far from camp, and, most carelessly, my gun was still unloaded, while I was examining some buffalo spoors, when, on looking up, I saw my gun-bearer, who had my cartridges, running away at full speed. Knowing that he must have seen something to frighten him so, I did not shout, but went to where he had been standing a few yards ahead, and there, sure enough, not twenty yards off, were a pair of lions. They were both full grown, and the male had an immense mane, and formed altogether as handsome a pair as I ever saw. The lioness was rolling on her back, playfully striking at her lord and master with her fore-paws just like a kitten, while he stood gravely and majestically looking on."



THE TIGER AND THE TIGRESS.

THE TIGER (*Felis tigris*).

Whether the lion or the tiger is the more powerful animal, is a question which has given rise to much discussion, but, as we have already mentioned, the opinion of one most competent to decide is in favour of the superiority in this respect of the latter. The absence of the mane, which forms such a striking feature in the male lion, renders, however, the appearance of the tiger decidedly less imposing, and hence the second position in the series is commonly assigned to this "cat."

In spite of the difference in coloration, the lion and the tiger are very closely allied animals, both agreeing in having a circular aperture for the pupil of the eye, and also in regard to the characters of the so-called hyoid bones which support the tongue.

Next to the absence of the mane in the male, and likewise of any tuft at the extremity of the tail, the most important external difference between the lion and the tiger is that of colour. The general ground-colour of the fur of the tiger is a rufous-fawn on the upper part and sides of the body, but the tint may vary in different individuals from pale rufous to brownish-yellow, the under-parts of the body being white. This rufous ground-colour is striped transversely with black throughout the head, body, and limbs, while the tail is ringed with black. The ears are black, with the exception of a large white spot. These striking colours, which are fully developed at birth, are brightest in young and vigorous animals, gradually fading in intensity with advancing age: and it is stated that tigers inhabiting forest districts are the reddest in ground-colour. As rare exceptions, both white and black tigers are occasionally met with. Thus a white tiger, in which the fur was of a creamy tint, with the usual stripes faintly visible in certain parts, was exhibited at the old menagerie at Exeter Change about the year 1820. A second example of a white tiger was recently obtained at Puna, India, by Major D. Robinson, of the Lancashire Fusiliers, and it appears to have been a male in the prime of life; while Colonel H. H. Godwin-Austen states that he has known of a third specimen. A perfectly black tiger, according to Mr. C. T. Buckland, was found dead many years ago near Chittagong, on the north-east frontier of India.

With the exception of a ruff of longish hair round the neck and throat of old males, which represents the mane of the male lion, the hair on the head and body of the Indian tiger is generally short and thick, but it is considerably more elongated and shaggy in Siberian examples. There is, moreover, a certain amount of variation in the length of the hair of the Indian tiger according to the season of the year.

The tail of the tiger, in both sexes, tapers regularly from root to tip: its total length being about half that of the combined length of the head and body.

When describing the lion, it has been mentioned how the skull of that animal can be distinguished at a glance from that of a tiger. And it may be added that a tiger's skull, according to Mr. Blanford, is, on the average, even wider and more massive than that of the lion. Moreover, in correlation with the more curved profile of the head of a tiger, as compared with that of a lion, the skull has its outline more convex, while the inferior border of the lower jaw is also straighter.

The tiger stands lower on the limbs than the lion, and is thus proportionately longer in the body. In regard to the size attained by tigers there has been even more exaggeration than in the case of the lion: this being in great part due to the measurements having been taken either from skins after they had been removed from the animal and pegged out on the ground to dry, or from tigers which had been carried for several hours thrown across the backs of elephants, and thus considerably stretched beyond their normal length. Mr. Blanford states that full-grown male tigers measure from $5\frac{1}{2}$ to $6\frac{1}{2}$ feet from the tip of the nose to the root of the tail: the length of the tail being about 3 feet. In one example, whose total length was 9 feet 6 inches, the length of the head and body was 6 feet 4 inches, and that of the tail 3 feet 2 inches. Female tigers are generally about a foot shorter in the length of the head and body than males. The height of a tiger at the shoulder varies from about 3 feet to 3 feet 6 inches.

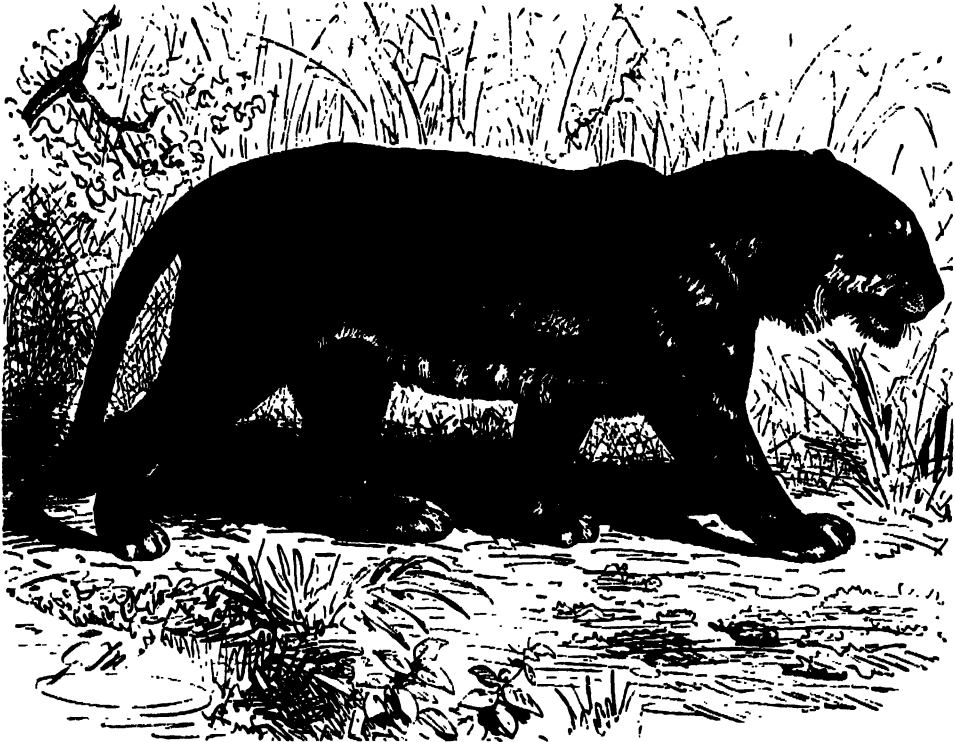
The above dimensions are taken in a straight line, but the usual manner of measuring a tiger adopted by sportsmen is to follow the curves of the body, when the dimensions will, of course, be somewhat greater; and it appears that all the largest tigers on record have been measured in this manner. Full-grown tigers thus measured vary from 9 to 10 feet in length; and tigresses from 8 to 9 feet. Unusually fine specimens will, however, reach, or even slightly exceed, a length of 12 feet: 12 feet 2 inches being apparently the maximum dimensions ascertained with any approach to accuracy. It is, however, by no means invariably the case that tigresses reach the minimum length mentioned above, Mr. Blanford stating that he killed one apparently adult example that was only 7½ feet long, while a second measured but 7 feet 8 inches.

There is still need of additional information as to the maximum weight attained by tigers. Sanderson gave the weight of a fine male tiger killed by himself as 350 lbs.; while specimens weighed by the late Sir W. Elliot weighed 362 and 380 lbs. Forsyth concluded, however, that some unusually large tigers, which fell to his own rifle, must have weighed from 450 to 500 lbs. These extreme weights have, of late years, been confirmed by Mr. W. T. Hornaday, who records a tiger measuring 9 feet 11½ inches in length, of which the weight was upwards of 495 lbs. The Maharaja of Kuch-Bihar has killed tigers which are stated to have varied from 481 to 540 lbs.; and one shot by Mr. F. Shillingford, of which the length was 9 feet 10 inches, weighed a little over 520 lbs. The weight of a tiger depends, of course, largely upon the condition of the animal at the time of its death; and if a specimen under 10 feet in length will turn the scale at over 500 lbs., it may be taken as certain that those of 11 or 12 feet in equally good condition must reach considerably heavier weights.

Although mainly, if not entirely, confined to Asia, the tiger has an extensive geographical distribution on that continent and its islands. To the westward its range appears to be limited by the mountains of Ararat and the Caucasus, whence it extends along the southern shores of the Caspian—the ancient Hyrcania—into Northern Persia, the Herat district, and thence into Turkestan. Thence it ranges over a large portion of Central Asia, embracing Southern Siberia, to a line some distance north of Irkutsk, and the whole of Mongolia as far eastwards as Amurland and the Island of Saghalien. And its fossil remains have been obtained, in company with those of the mammoth, from the New Siberian Islands lying some distance within the Arctic Circle. From Mongolia the range of the tiger extends southwards through China to Burma, Siam, and the Malay Peninsula; and it also embraces the Islands of Sumatra and Java, but not, it is said, Borneo. Across the Assam district, at the northern end of the Bay of Bengal, the tiger ranges into India, where it is found from Cape Comorin to the Himalaya; although quite unknown in the Island of Ceylon. The whole of the elevated plateau of Tibet forms, however, an island in its distributional area into which the tiger does not intrude. And, as we learn from Mr. Blanford, it is equally unknown in Afghanistan and Baluchistan, as well as in that portion of Persia lying to the southward of the Elburz Mountains. From this extensive distribution it is evident that the popular idea of regarding the tiger as a tropical animal is quite erroneous. And it is even doubtful—in spite of the

world-wide reputation of the Bengal tiger—whether those inhabiting the warmer regions are its most magnificent examples. In spite of this, the tiger is so intimately associated with and characteristic of India, that it will always—and rightly—be regarded as the special emblem of that country. Mr. Blanford believes that the absence of the tiger from Ceylon may be taken as an indication that the animal is a comparatively recent immigrant into Southern India, since most of the other Indian Mammals are found on both sides of the Straits of Palk.

Although in some of the more thickly populated districts of India, especially



THE BENGAL TIGER ($\frac{1}{2}$ nat. size).

those well supplied with railroads, such as parts of Bengal, the Central Provinces, and Bombay, tigers have greatly decreased in numbers, or have well-nigh or completely disappeared, in the wilder and more sparsely inhabited districts they are often still abundant. Indeed, wherever large tracts of forest and grass jungle remain in India, there tigers are to be found in more or less abundance.

In the fever-stricken swamps and islands forming the so-called sandarbans of Lower Bengal, tigers are especially common: as they also are in the forests of Burma and Assam. Formerly, Sir Samuel Baker tells us, they were to be met with in the grassy islands of the Bramaputra, but the navigation of that river by steamers has led to a large reduction in their numbers. In the forests flanking the easterly Himalaya, and known as the Terai, tigers still abound; and

they will at times ascend in the mountains to heights of six thousand or seven thousand feet above the sea-level, although they are unknown in the interior of the Himalaya. In some parts of India it was necessary to take active measures against them, in order to prevent the annihilation of the population. Thus a recent writer states that in Manipur "tigers used to be so numerous that the inhabitants were formed into groups for the purpose of marking them down and destroying them. This organisation still exists. The groups are called *kai-roop*, and it is the duty of the chief of the *kai-roop* of the district to report to the raja whenever a tiger appears within his jurisdiction: the order is then given to destroy him: this is done by surrounding the patch of jungle in which he has hidden, after killing a cow or deer, with strong nets. Outside these, tall bamboo palisading is erected, and information is sent to the raja, who, if the place is within easy distance, proceeds there with all his court, ladies included. The spectators are ranged on seats at intervals at the top of the palisading, and the tiger is driven by firebrands from his retreat, and either shot or speared. The Manipuris are very keen at this sport, and I have seen them, despite a prohibition to the contrary, descend into the area (perhaps a space of three hundred yards, or even more, in circumference) and, protected only by the net held up by a forked stick in the left hand, boldly attack the tiger with a spear. Generally, the real sport is shown with the spear, and the *coup de grace* given by a rifle shot. Anyhow, the men engaged display great courage and coolness, and the whole affair is not a vulgar piece of butchery but a game of skill, till a well-directed shot ends it." Towards the western end of the Himalaya, where forests become much thinner and the whole country is much drier, tigers gradually become less common: and in the Western Punjab and Sind they are either very rare or quite unknown.

In parts of Java and Sumatra tigers absolutely swarm: and a firm of Dutch merchants at Padang, Sumatra, writing in the autumn of 1891, stated that the arrivals of coffee from the interior were much below the usual average, on account of the number of tigers infesting the route: upwards of fifty men having been killed by them while engaged in bringing the coffee down country.

Writing of the distribution of these animals in Persia, the late Sir O. B. St. John states that tigers, twenty years ago, were very numerous in the Caspian provinces of Persia, and in the Caucasus as far as the mouth of the Araxes. The dense vegetation, which although of a temperate character, yet attained a tropical luxuriance, affording them shelter as perfect as that of the jungles of the Terai, or the swamps of the sandarbans of Bengal.

Although when the animal is seen within the narrow limits of the cage of a menagerie, or stuffed in the case of a museum, the brilliant coloration of the tiger may appear conspicuous in the extreme, yet there is little doubt that in the native haunts of the animal it is essentially of a protective nature. Sir J. Fayrer, in his work, *The Royal Tiger of Bengal*, observes, that brilliant as is the general colour of the tiger, "it is remarkable how well it harmonises with the grass bush among which he prowls, and for which, indeed, until his charge, and the short deep growls or barkings which accompany it, reveal his presence, he may be mistaken."

Indeed, the vertical stripes of tawny orange and black on the skin of the tiger harmonise so exactly with the broad blades of yellow grass, separated by equally broad lines of blackest shade, that it is often difficult indeed to distinguish the animal from his surroundings when seen in his native jungle during an Indian summer. And, in this connection, it is noteworthy that the tigers of Northern Asia, where dry grass-jungles like those of India are unknown, are stated to have the ground colour of their skins of a much less brilliant hue.

The literature relating to the habits and mode of life of the tiger is even more extensive than is the case with the lion; while that devoted to tiger-shooting is simply appalling in quantity. While the terms noble and majestic are those which were formerly, and are often still applied to the lion, the epithets cunning and cruel are more generally assigned to the tiger; while the word "tigerish" has become an integral portion of our language to denote ferocious cruelty. It may be doubted, however, whether these epithets are really more exclusively applicable to the one than to the other animal, when the different conditions under which they live are taken into account. It is true, indeed, that the amount of damage done by tigers is vastly greater than that which can be charged to lions: but then it must be remembered that, whereas the former frequently inhabit more or less densely-populated districts, the latter are often found in regions where there are but few human inhabitants, and but small numbers of cattle. Then again, the more warlike nature of many of the African races, as compared with those of India, is fatal to the existence of man-eating lions, whereas man-eating tigers in India are frequently regarded with superstitious reverence, and no attempts are made at their destruction.

Although there is a great difference in the habits of individual tigers, according to whether they live on wild game killed in the jungles, or on domestic cattle, or are man-eaters, yet the whole of them have certain characters in common. Thus, as a rule, the Indian tiger is a solitary and unsociable animal, although at certain seasons of the year the pairs of males and females associate more or less closely together. In all cases the male consorts with but a single female: but it has not yet been definitely ascertained whether this union is permanent. Occasionally, however, as many as four, five, or even six, full-grown tigers have been seen in company; and it appears that these are always family parties, the cubs having remained with their parents till grown up. Like the lion, the tiger is essentially nocturnal, lying concealed in the long grass or forests till evening, and then issuing forth for its nightly prowls. Their wanderings during the cold and wet seasons at least are considerable, and it is considered by Sir J. Fayrer that at such periods of the year they have no fixed abodes. During the hot season, however, when the whole country is burnt up with the heat, and the smaller streams, pools, and tanks are dry, the range of the Indian tiger¹ becomes much more restricted. At such times it takes up one definite "beat," haunting the banks of the rivers, and patches of long grass which are kept fresh and green by growing near water, or in swampy ground. And it is remarkable, as Sir Samuel Baker observes, that when a tiger with a restricted beat is killed, in the course of a few months another

¹ As almost the whole of our knowledge of the habits of tigers is derived from India, our remarks apply in great measure only to those of that country.

will occupy its place, frequenting the same lairs, and drinking at the same pools. Grass-jungles and swamps are, however, by no means the sole haunts of the tiger, which will frequent any kind of country that will afford the necessary shelter and a plentiful supply of water. In addition to forests, tigers select as their lurking-places, clefts and caves in rocks, the shelter afforded by a high bank, or the grass-grown ruins of the numerous deserted cities to be found in many parts of the plains of India. And it is curious to observe that in many cases one particular rock, or one patch of grass, is always inhabited by a tiger, while another, apparently equally suitable, has no such tenant. Moreover, in the plains of India, wherever tigers are met with, there will wild peafowl invariably be found.

Tigers are extremely impatient of the fierce heat of the dry season, and always try to shelter themselves as much as possible from the burning rays of the sun. This impatience of extreme heat, taken in conjunction with their occurrence in comparatively cool climates, like those of Northern China, Manchuria, and parts of Siberia, where the winters are severe, is in favour of the view of Mr. Blanford, already mentioned, that these animals are comparatively recent immigrants into a large portion of India. To aid in mitigating the heat of the dry season, tigers are in the habit of wallowing in the shallow water of swamps and the margins of rivers, and then rolling in the dry sand after their mud-bath. Such, at any rate, are their habits in the plains of Bengal, Assam, etc.: but it has been stated that on the Nilgiri Hills, in Southern India, tigers are never known to wallow in this manner. Not only does the tiger indulge in such wallowings during the hot season, but he is also an excellent swimmer, and will take readily to the water. In the Bramaputra, where reedy and grassy islands and sandbanks, locally known as *churs*, intercept the course of the river, tigers, as Sir Samuel Baker tells us, swim for miles during the night from island to island in search of prey, and if unsuccessful return at dawn to the mainland. They likewise display very similar habits in the Bengal sandarbans, where they not unfrequently cross small arms of the sea. Sometimes they are compelled to take involuntarily to the water, as in the case of the great inundations in the valleys of the larger Indian rivers, or when tidal waves overflow the low-lying lands bordering the Bay of Bengal. On such occasions the unfortunate animals are often put to sore straits to find a refuge from the waste of waters, and Sir Samuel Baker relates an instance of a tiger, during an inundation on the Bramaputra, having climbed up during the night on the high rudder of a vessel, much to the astonishment and alarm of the native steersman, when he beheld his visitor in the morning. From this position the tiger made his way to the deck of the steamer towing the barge, where he was eventually killed in the paddle-box.

In spite of its predilection for water, the tiger can, however, at a pinch endure thirst for a considerable period, even in the hottest weather. As an instance of this we may refer to an account given by Mr. G. P. Sanderson, where two tigers were surrounded by nets in a small patch of jungle. "The weather," writes the narrator, "was hot; the circle in which they were enclosed was only seventy yards in diameter, and the heat of the fires kept up day and night all round was considerable. Still they existed without a drop of water for ten days, suffering from wounds half

the time. A tiger can go much longer than this without food without serious inconvenience." Like lions, tigers are bad climbers, ascending trees but rarely, and, according to Mr. Blanford, being quite incapable of ascending a vertical stem, no matter what may be its dimensions. But, when aided by a sloping stem, or by a fork at some distance from the ground into which they can spring and thence obtain a fresh start, tigers will occasionally attack sportsmen who are waiting for them in trees. It is also stated that, when caught by inundations, tigers will endeavour to escape by climbing. Stems of trees, especially certain particular favourites, are in tiger-haunted districts marked by the vertical scorings in the bark made by the claws of tigers; these markings not unfrequently extending to a height of at least ten feet.

The idea that tigers are in the general habit of springing appears to be a popular delusion; and, according to Mr. Blanford, it is but rarely that they move their hind-legs from the ground, except when they have occasion to clear a fence or other obstacle. When so inclined, they are undoubtedly able to spring to a considerable height; and an instance is on record of a tiger having, at a single spring, pulled a native from a tree, at a distance of eighteen feet from the ground. Mr. Sanderson gives fifteen feet as the maximum horizontal distance that a tiger can spring. "The tiger's usual attack," writes Sir J. Fyfe, "is a rush, accompanied by a series of short deep growls or roars, in which he evidently thinks he will do much by intimidation; when he charges home he rises on the hind-feet, seizes with the teeth and claws, and endeavours and often succeeds in pulling down the object seized." The mention of the tiger's attack reminds us that, according to Sir Samuel Baker, it is but comparatively rare that one of these animals, when suddenly and unexpectedly disturbed, will fly at a human being. "The truth is that the tiger seldom attacks to actually kill, unless it is driven, or wounded in a hunt. It will frequently charge with a short roar if suddenly disturbed, but it does not intend to charge home, and a shout from a native will be sufficient to turn it aside; it will then dash forward and disappear, probably as glad to lose sight of the man as he is at his escape from danger."

In many of the foregoing traits of character the tiger resembles more or less closely the lion; but whereas the latter is an extremely noisy animal, the former roars much less frequently. Mr. Blanford, who has especially called attention to this difference in the habits of the two animals, observes that, where lions "are common, scarcely an evening passes without their being repeatedly heard. I have often been in places where tigers were equally abundant, but it is the exception for their roaring to attract attention. Their usual call is very similar to that of the lion—a prolonged, moaning, thrilling sound, repeated twice or thrice, becoming louder and quicker, and ending with three or four repetitions of the last portion of it. Besides this there is a peculiar loud 'woof' produced when the animal is disturbed or surprised, a growl that it utters when provoked, and the well-known guttural sound of rage repeated two or three times when it charges. When hit by a bullet a tiger generally roars, but tigresses, at all events, very often do not: I have on three occasions, at least, known a tigress receive a mortal wound and pass on without making a sound."

With regard to the breeding of tigers, it appears that the number of cubs

produced at a birth usually varies from two to five, although it is said that there are occasional instances where the litter includes as many as six. As the result of his long experience, Mr. Sanderson gives two as the usual number, three being much rarer, and only two instances of four in a litter having come under his personal observation. Mr. Blanford states, however, that he has on more than one occasion seen four cubs. When there are but two, it appears that while one is a male the other is a female; and this general equality in the sexes of a litter renders it difficult, as Mr. Sanderson remarks, to account for the large preponderance of adult tigresses over tigers. Tigresses appear to breed at all times of the year; young cubs having been taken by Mr. Sanderson in the months of March, May, and October. Tiger-cubs, which require a period of about three years to attain maturity, remain with the tigers for the greater part of that time; and, as already mentioned, when several adult tigers are found together, the party is a family one. Mr. Sanderson is of opinion that the tigress does not breed oftener than once in two years; while from the circumstance that the cubs do not attain maturity till that period, Forsyth considered that once in three years was the minimum. In captivity tigers breed much less freely than lions, and the cubs are far more difficult to rear. Although when caught young tigers can be easily tamed, they are more intractable than lions when taken at a later age.

The food of individual tigers varies greatly, according as they frequent uninhabited or populous districts. The typical jungle tiger lives chiefly upon the various species of deer, wild pigs, and antelopes; but it will kill domestic cattle, and will also eat porcupines, monkeys, peafowl, and other small animals. Although full-grown buffalo and gaur are usually a match for it, young or feeble individuals not unfrequently fall victims to its attack; and instances are recorded of young elephants being killed and eaten. Adult bull gaur are, however, occasionally killed by tigers; the latter, according to the report of native herdsmen, inducing the bulls to charge time after time, when they are wounded as they pass by a blow on the flanks from the tiger's paw. Old wild boars will, it is said, not unfrequently succeed in wounding and beating off a tiger; and the herds of buffaloes defend themselves by forming in a half-circle, with the bulls facing the foe. Moreover, even when a calf, or a weak or sickly adult individual has been carried off, the old buffaloes are reported to combine and follow the tiger and rescue the victim from his clutches. Much more rarely tigers will kill and eat the Indian bear; and Mr. Sanderson relates an instance of a tiger having habitually taken to killing and eating those animals. That the male tiger will sometimes devour his own offspring is well authenticated; and Mr. Sanderson was informed, on what he considers good authority, of an instance where three tigers devoured another individual of their own species.

The "kill" of the tiger is frequently kept until, in the hot climate of India, it assumes a putrid condition; and, in addition to carrion of this nature, there is good evidence that tigers will eat the decomposing flesh of animals other than those killed by themselves. The tigers dwelling near villages are, unless they are man-eaters, in the habit of living more or less entirely on the small native cattle, which are generally, and especially in the dry season, in miserable condition. In Central Asia, where, according to Eversmann, the tiger is abundant in the reed-

thickets on the east bank of the Sea of Aral and the Sir Darya, as well as in the Kirghiz steppes, its chief food is derived from the wild swine which inhabit those thickets, and also from the herds of wild asses and saiga antelope frequenting the more open country. In these districts the tiger is much dreaded by the nomadic inhabitants; and it is said to attain dimensions considerably greater than those which it reaches in warmer regions.

Much misapprehension has prevailed as to the mode in which tigers kill their prey; the ordinary notion that they spring upon their victims from a distance, and after killing them either by a blow from the paw, or by tearing at the throat with their claws, and afterwards sucking the blood, being now proved to be incorrect. Mr. Sanderson, who has paid particular attention to these points, and whose explanation, although at variance with that of some other experienced sportsmen, is now pretty generally accepted, writes as follows on the subject:—"I have never witnessed a tiger actually seize its prey, but it has been described to me by men who have seen the occurrence scores of times within a few yards' distance while tending cattle. The general method is for the tiger to slink up under cover of bushes or long grass, ahead of the cattle in the direction they are feeding, and to make a rush at the first cow or bullock that comes within five or six yards. The tiger does not spring upon his prey in the manner usually represented. Clutching the bullock's fore-quarters with his paws, one being generally over the shoulder, he seizes the throat in his jaws from underneath, and turns it upwards and over, sometimes springing to the far side in doing so, to throw the bullock over, and give the wrench which dislocates its neck. This is frequently done so quickly that the tiger, if timid, is in retreat again almost before the herdsman can turn round. Bold animals often kill several head, unsophisticated cattle occasionally standing and staring at the tiger in stupid astonishment; but herds that are accustomed to these raids only enter the jungle with extreme unwillingness." Occasionally the tiger seizes its prey by the nape of the neck: the blow of his paw will, however, stun even a large animal: and it is quite possible that cattle may be killed in this manner. Tigers will on rare occasions kill buffalo and gaur, and similar prey, by hamstringing them, probably by a blow with the claws. Such hamstrung animals are occasionally met with, but the exact method in which it is accomplished remains unknown. The notion that the tiger sucks the blood of his victim is a myth. The late afternoon is the time at which cattle are usually seized by tigers when grazing in the jungles, although they may be struck down at any time of the day. If killed during the daytime the carcase of the victim is usually left where it lies till evening. At nightfall, or perhaps earlier, the tiger returns to the "kill," and either commences to devour it at once, if the spot is sufficiently secluded, or proceeds to remove it to one more convenient. The feast is commenced on the hind-quarters as a general rule; and, after he has satisfied his appetite, the tiger may either retire to a convenient resting-place in the neighbourhood, from which it can rush out to drive away jackals and other intruders from the "kill," or may completely conceal it under bushes and leaves, and seek a more distant lair in the neighbourhood of water. When it has recovered from the effects of its gorge, the tiger returns for a second meal; and it appears that in about three days the carcase is reduced to

little more than a skeleton. During the intervals between his meals, the tiger is sluggish and stupid, being with difficulty roused from his slumbers, and when so awakened he is dull and indisposed to show fight.

Although it has been much exaggerated, the strength displayed by a tiger in carrying off his prey is enormous. The weight of the ordinary Indian cattle, according to Sir Samuel Baker's estimate, may be set down roughly at from 350 to 400 lbs. And although it is quite an error to suppose that a tiger can take a carcase of that weight and carry it in his mouth without letting any portion of it drag on the ground, at least at intervals, yet it is quite certain that he can carry it. Thus, Mr. Sanderson relates how a powerful tiger had taken up and carried the carcase of a bullock through a dense thicket for about three hundred yards; while a smaller tigress carried one in open jungle for a shorter distance. As a general rule, however, the bodies are dragged along the ground; although this, when the nature of the surface in Indian jungles is taken into account, is a sufficiently formidable task.

Forsyth considered it probable that a cattle-killing tiger destroyed a victim about every fifth day; three days being employed in feasting on the carcase and resting in the intervals, while during the other two food was not specially sought. This, when we remember the number of these animals in certain parts of India, will give some idea of the losses they occasion. According to a return issued by Government, it appears that in the Madras Presidency, during the quarter ending 31st December 1891, the number of animals killed by tigers and leopards included 656 bullocks, 752 cows, 236 calves, 135 buffaloes, 105 sheep, and 103 goats. In the returns for all India for one year, during which 1835 cattle were killed, the total loss was set down at a little short of 60,000 head, of which 20,000 were assigned to tigers, and an equal number to leopards. Although the man-eating tiger is much more dreaded, the cattle-lifting tiger is regarded with supreme indifference by the herdsmen of the districts it infests. "It is no uncommon feat," observes a well-known popular writer, "for a party of jungle herdsmen armed only with their iron-bound *lathis*, or quarter-staves, to boldly show fight to the royal robber, and by sheer pluck and gallant daring beat him off from some member of their herd that he may have attacked. Too frequently, to be sure, some one or more of the number may pay dearly for their temerity, but it is an apt illustration of the fact that men get inured to a commonly-incurred danger." Mr. Blanford mentions that he once came across two children, of which the elder was not more than eight or nine years of age, who had actually been placed in the jungle as a guard over the dead body of a bullock, to protect it from the return visit of the tiger by which it had been slain.

It has been considered that man-eating tigers, which generally belong to the female sex, were invariably animals unable to procure other food, from the effects of age. Although this is true in a very large number of instances, it appears that tigers may take to man-eating from a variety of other causes. Thus either wounds, excessive fat, or the fact of a tigress having had to bring up a family of cubs where food is scarce, may be the original cause of the adoption of this mode of life. According to Mr. Sanderson, all man-eaters were invariably at first cattle-stealers, which gradually became accustomed to the sight and presence of man, and thus lost their instinctive fear of the human race. When once a tiger has taken to

man-eating, and has discovered how easily its victims are killed, it appears that it ever afterwards hunts the same kind of prey, although only some individuals confine themselves to this kind of food. Those tigers which are entirely or mainly man-eaters inflict fearful havoc on the unfortunate natives among whom they have taken up their quarters; an average native of India, as Sir Samuel Baker remarks, forming by no means a hearty meal for a tiger.

All who have had to do with them are unanimous as to the extreme wariness and caution of man-eaters, which from this cause are the most difficult to kill of all tigers. The slightest rustle or whisper on the part of the pursuer is, according to Mr. Sanderson, sufficient to put the man-eater on its guard; and it is marvellous



THE STRUGGLE IN THE STREAM.

with what sagacity these animals distinguish between an armed sportsman and a helpless unarmed native. "The man-eater," says Sir Samuel Baker, "will seize an unsuspecting native by the neck, and will then drag the body to some retreat in which it can devour its prey in undisturbed security. Having consumed the hind-quarters, thighs, and more fleshy portions it will probably leave the body, and will never return again to the carcase, but will seek a fresh victim, perhaps at some miles distance, in the neighbourhood of another village."

In order to rid themselves of these pests, the natives of India and other countries have had recourse to all kinds of traps and other devices. Among these, pitfalls used to be a favourite method. According to Mr. Wallace, in Sumatra these pits are made in the form of an iron-furnace, wider at the bottom than at the top, and from about fifteen to twenty feet in depth; a sharpened stake being fixed at the bottom. The top of the pit is then covered over with branches and leaves, and so perfect is the concealment, that Mr. Wallace states that he has more than once had a narrow escape from falling into these pits. Indeed, one unfortunate traveller was killed by a fall on to the sharpened stake, after which that portion of the contrivance was forbidden. Large mouse-trap cages for catching tigers alive were formerly sometimes used in certain parts of India; but Mr. Blanford states that these were more successful in catching leopards than tigers. Poisoning the "kill" of a tiger is also a method that has been more or less successful; while bows with poisoned arrows and spring-guns set in the tiger's path have also been called into requisition. In certain parts of the Mysore district Mr. Sanderson states that the villagers are in the habit of surrounding tigers with nets, and then spearing or shooting them; this, except watching, being the only means by which they can be killed in covert which is too dense to admit of driving. In Orissa, on the upper part of the Eastern Coast of India, and perhaps elsewhere, the natives, according to Mr. Blanford, construct a gigantic figure-4 trap loaded

with a platform of heavy stones, that falls upon and crushes the tiger, after the manner of the brick or tile trap used by gardeners in this country to kill field-mice. In some of the older works relating to the tiger there will be found circumstantial accounts of a method of capturing the animal by smearing leaves with bird-lime, which adheres to its face and paws, and thus renders it completely blind and helpless; but Sir J. Fayerer states that he is unaware of any authenticated instance where this method has been put in practice.

No account of the tiger would be complete without some reference to the modes of hunting or shooting adopted by Europeans and many of the native chiefs and shikaris, but as all these are fully described in works more especially devoted to sport, such reference will be of the briefest. One plan, especially favoured by the native shikari, who is less impatient of a solitary night watch than most Europeans, is to build a platform or *machan* in a tree near the "kill," from which the tiger may be shot on his return visit, a variation of this plan being to construct the machan in any likely spot, and to tie up a goat, cow, or buffalo as a bait. The uncertain light prevailing at the time of the tiger's visit renders shooting from these machans far from certain. Throughout a large portion of Bengal, the North-West Provinces, Central India, and the Terai-land at the foot of the Himalaya, where tigers are generally found in swamps and grass-jungle,—the grass in the latter being often from eight to ten feet in height,—the common, and indeed often the only practicable plan, is to beat the jungles with lines of elephants: the sportsmen either shooting from their howdahs, or from machans placed in trees in positions commanding the ways along which the tiger is likely to bolt. In other districts, and more especially in parts of Bombay and Madras, tiger-shooting is often undertaken on foot. And, as Sir J. Fayerer observes, it is in this dangerous sport that fatal and serious accidents are likely to happen, for no accuracy of aim or steadiness of nerve can always guard against or prevent the rush of even a mortally wounded tiger, that in its very death-throes may inflict a dangerous or fatal injury.

Stories of hair-breadth escapes from tigers, both when shooting on foot and from the howdah, might be collected almost by the hundred, but would be foreign to our purpose. We may, however, mention that in many parts of India the tiger is regarded by the natives with a superstitious awe, which prevents them from killing it, even when they have the power. As might be expected, this awe is more developed among the superstitious Hindus than among the Mohammedans. In all cases, however, it appears that the natives have no objection to the slaughter of the tiger by Europeans. Frequently the tiger is regarded as tenanted by a spirit rendering it immortal: and in many districts the animal is never mentioned by its proper name, *sher* or *bagh*, but invariably by some euphemism. Closely connected with this superstition is the avidity with which the claws, whiskers, front teeth, and the imperfect collar-bones of the tiger are collected and preserved as charms by the natives of many districts; although, by others they are held as deadly poisons, and are destroyed as soon as possible. For these reasons a tiger-skin with the whiskers preserved is a rarity.



THE LEOPARD ($\frac{1}{12}$ nat. size).THE LEOPARD (*Felis pardus*).

The third in point of size of the Old World cats is the leopard, or panther, a species closely allied to the lion and tiger, from whom it is at once distinguished by its coloration and inferior dimensions. In many works, written more from the sporting than the purely zoological point of view, it will be found that two species of large spotted cats are recognised as inhabiting Africa and India, to the smaller of which the name leopard is restricted, while the larger is known as the panther. Although there is an enormous amount of difference between the smallest and the largest of such spotted cats in point of size, yet, in the opinion of those who have paid most attention to the subject, the transition from the one to the other is so gradual and complete that, in a large series of specimens, it is quite impossible to say where leopards end and panthers begin. Hence it is concluded that there is but a single species, for which the name leopard should be adopted. The spotted coat of the leopard being its most distinctive feature, the animal (in common with the hunting-leopard) is known to the natives of India as the chita, meaning spotted; the leopard, on account of its larger size being often distinguished as the chita-bagh, or spotted tiger. By Europeans the name chita (or cheetah) has been very generally restricted to the hunting-leopard; but, as the above remarks show, there is no justification for this

use, and it is accordingly preferable to call each of the two animals by its English title. The ground-colour of the fur of the leopard is subject to considerable individual variation, but it is generally of a yellowish-fawn, with a more or less marked rufous tinge, becoming gradually lighter on the flanks, and thus passing into pure white on the under-parts. The spots, which are very variable in size and number, take the form of rosettes, and consist, on the upper-parts, of an irregular black ring (nearly always incomplete), enclosing a bright central area, which may be of the same tint as the general ground-colour, but is not unfrequently darker. On the head, lower portions of the limbs, and flanks (where they are brownish), the spots have no light centres, and are smaller. The tail, of which the length may vary from rather more than one-half to about three-quarters that of the head and body, is likewise spotted throughout the greater part of its length; but at and near the tip the spots become larger and fewer, and tend to form more or less nearly complete rings. Leopard cubs do not have the colours so well defined or so brilliant as in the adult animal. The hair on the head and body is generally short and close, but tends to become longer when the animal inhabits colder regions than usual, and that on the tail and under-parts is always longer than the rest. From this normal coloration an almost complete transition can be observed to black leopards, which were at one time regarded as belonging to a distinct species. Perfectly black leopards have been only found hitherto in Asia, and appear to be more common in the hills of Southern India, and the Malay Peninsula and islands, than elsewhere. The skin of such black specimens, when viewed in certain lights, invariably exhibits a kind of "watered-silk" appearance, due to the presence of the spots, in which the hair has a still deeper tinge of black than elsewhere. That such black leopards are nothing more than varieties is proved by instances where a female of the ordinary colour has given birth to a litter, among which was a black cub. One such instance is recorded by Mr. G. P. Sanderson as having taken place at the Zoological Gardens at Amsterdam, where a female gave birth to one spotted and one black cub.

Although no perfectly black leopards have ever been found in Africa, yet there occurs in the southern portion of that country a rare variety which exhibits a more or less strongly marked tendency towards blackness. One such specimen was described in 1885 by Dr. Günther, which was obtained in hilly land covered with scrub-jungle, near Grahamstown. The ground-colour of this animal was a rich tawny, with an orange tinge; but the spots, instead of being of the usual rosette-like form, were nearly all small and solid, like those on the head of an ordinary leopard; while from the top of the head to near the root of the tail the spots become almost confluent, producing the appearance of a broad streak of black running down the back. A second skin, figured by the same writer in the following year, had the black area embracing nearly the whole of the back and flanks, without showing any trace of the spots, while, in those portions of the skin where the latter remained, they were of the same form as in the first specimen. Two other specimens are known: the whole four having been obtained from the Albany district. It will thus be apparent that these dark-coloured African leopards differ from the black leopards of Asia, in that while in the latter the rosette-like spots are always retained, and are always visible, in the former the rosettes

are lost (as, indeed, is to a considerable extent often the case with ordinary African leopards), and all trace of spots disappears from the blacker portions of the skin. It is, however, noteworthy that in both countries these leopards are found in hilly regions, more or less thickly covered with jungle, from which it would seem that such districts are in some way connected with the abnormal development of dark colour. Far rarer than black leopards, are white ones, and but very few have



BLACK LEOPARD ($\frac{1}{12}$ nat. size).

been met with. In addition to these black and white varieties of the leopard, there are minor variations noticeable in the skins of specimens from different places. In the first place, as Mr. Blanford observes, African leopards always have smaller and more solid spots than the Indian animal, so that the skins of the two can be distinguished at a glance. Then there is a race of Persian leopards, also found in Baluchistan and Sind, in which the fur is longer, and the tail thicker than ordinary; while the coloration is intermediate between that of the ordinary leopard and the ounce. Further, according to the author just mentioned, the leopards from Peninsular India have less richly-coloured skins than

those inhabiting the damp forests of the Himalaya, Bengal, Assam, and Burma; and the spots on them are as a rule much smaller. Two leopards, the one from China and the other from Persia, described by M. A. Milne-Edwards, were remarkable for the circumstance that the markings on the flanks were more like rings than rosettes, while the tail in each case was shorter than the body alone.

The differences in the size of individual leopards is so great that while in the smallest examples the total length of the head, body, and tail does not exceed 5 feet, in the largest it reaches to as much as 8 feet. In a large male, of which the total length was 7 feet 11 inches, the head and body measured 4 feet 9 inches, and the tail 3 feet 2 inches.

The leopard is one of the three larger cats which are common to India and Africa; the other two being the lion and the hunting-leopard. The distribution of the leopard is, however, more extensive than that of the lion, embracing nearly the whole of Asia, from Persia to Japan, but not extending as far north as Siberia; while the animal is unknown on the high plateau of Tibet, where almost all the Mammals belong to peculiar species not found elsewhere.

Leopards occur over almost the whole of India, although absent from parts of Sind and the Punjab; and they are abundant in Ceylon, Burma, and the islands of the Malayan region. Westward they extend into Persia, Palestine, Arabia, and Syria, and thence into Africa, where they range from Somaliland and Algeria to the Cape Colony. This is, however, not all, since the evidence of fossil bones found in the caverns and superficial deposits of Western Europe proves that the leopard (or, at all events, a large cat of which the bones and teeth are indistinguishable from those of a leopard) formerly ranged as far west as Great Britain, France, and Spain. Its distribution is and was considerably more extensive than that of the lion, which, as we have seen, never extended eastwards of the Bay of Bengal; and it is larger than that of any other member of the Cat family except the lynx.

Next to the tiger in India, and to the lion in Africa, the leopard is the most formidable Carnivore (exclusive in India of bears) to be found in either country. In its habits it differs essentially from both the lion and the tiger in that it is thoroughly at home in trees, running up a straight-stemmed and smooth-barked trunk with the speed and agility of a monkey. Moreover, the leopard is a much more active animal than the tiger, frequently taking tremendous leaps and springs. Mr. Sanderson is of opinion that the Indian leopard, although its powers of offence are far inferior to those of the tiger, is in some respects a more dangerous animal, as it is roused with less provocation, and is more courageous in attacking those who disturb its repose. The favourite resorts of the Indian leopard are rocky hills covered with scrub, among which it seeks secure hiding in caves and under overhanging masses of rock. From strongholds such as these, writes Mr. Sanderson, the leopards in Southern and Central India "watch the surrounding country towards sunset, and descend with astonishing celerity and stealth, under cover of the rocks, to cut off any straggling animal among the herds or flocks on their return to the village at nightfall. From their habit of lurking in the vicinity of the habitations of man, to prey upon cattle, ponies, donkeys, sheep, goats, and

dogs, leopards¹ are frequently brought into collision with Indian villagers: and a leopard being mobbed in a garden, or field of sugar-cane or standing corn, from which he will charge several times, and bite and claw half a dozen before he is despatched or makes his escape, is no uncommon occurrence in India. At night leopards frequently find their way into goat-folds or calf-pens, climbing over walls or the roofs of native huts in their burglarious inroads, and carrying off their prey with great boldness and agility. They appear to have a peculiar *penchant* for dogs: and I have known many villages in parts of Mysore where leopards were numerous, in which not a dog was to be found, or perchance but one or two, which would be pointed out by their owners as very lucky ones, they having



LEOPARD ON THE PROWL.

escaped sometimes from the very clutches of their unceasing foe, whilst their companions had successively fallen victims to his stealthy attacks."

This partiality of the leopard for dogs seems to be characteristic of the animal from one end of India to the other, and there are many instances on record where leopards in the hill-stations have swooped down in broad daylight and carried off pet dogs from before the very eyes of their European masters or mistresses. It is but rarely that leopards take to man-eating, but instances do occur, one of which came under the notice of the present writer some years ago, when a leopard carried off a considerable number of persons from a village in Kashmir. In Africa the general habits of the leopard appear to be very much the same as in India, Sir Samuel Baker relating how, on one occasion, a dog was carried off from the very middle of his camp by one of these marauders.

In addition to dogs, which can, of course, be obtained only in the neighbour-

¹ In this extract we omit Mr. Sanderson's use of the word panther whenever he refers to the leopard.

hood of villages, leopards prey largely upon the langurs and other monkeys which haunt the rocky hills. Indeed, few animals come amiss in the way of food; about the largest which he is capable of killing being the sambar deer, or an Indian bullock.

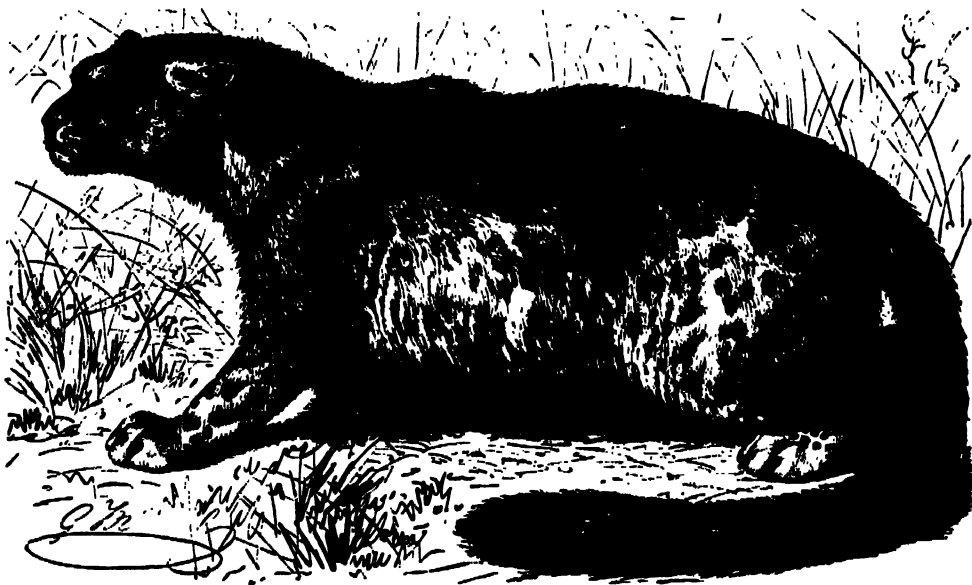
In killing its prey, the leopard, writes Sir Samuel Baker, seizes by the throat, and clings with tenacious claws to the animal's neck, until it succeeds either in breaking the spine or in strangling the victim, should the bone resist its strength. When the animal is dead, the leopard never attacks the hind-quarters first, according to the custom of the tiger, but it tears the belly open and drags out all the viscera, making its first meal upon the heart, lungs, liver, and inside generally. It then retreats to some neighbouring hiding-place, and, if undisturbed, it will return to its prey a little after sundown on the following day. Mr. H. Hunter remarks that in Africa the leopard nearly always puts the remains of his "kill" up a tree, probably for the purpose of protecting it from the attacks of hyænas. On one occasion the skeleton of a lesser kudu antelope was found in the fork of a branch, which it was believed had been placed there by a leopard, and Mr. Hunter on several occasions saw one of these animals descending from a tree.

It has yet to be mentioned that the leopard does not display that marked partiality for the neighbourhood of water so characteristic of the tiger, many of its haunts in the hills being in districts which are absolutely dry. On occasion, however, it will take to the water as readily, and swim as well as a tiger. Although usually found singly or in pairs, leopards, in Africa at least, may sometimes be found in parties comprising several full-grown individuals: probably, however, these are all members of a single family. The leopard is a still more silent animal than the tiger, seldom giving vent to any sound, except when disturbed or charging an enemy, when it utters a short roar. According to Captain Baldwin, who is supported by Mr. Blanford, its real cry, which is but seldom heard, is quite different from the roar of a tiger, and takes the form of a harsh noise, something between a grunt and a cough, which is repeated three or four times. In India the female leopard gives birth to its young in the spring, during the months of February and March, two, three, or four cubs composing a litter. Young leopards are said to be more difficult to tame than either lions or tigers, and the adult when in captivity always displays an uncertain and morose disposition.

With regard to leopard-hunting, Sir Samuel Baker observes that "it is far more difficult to circumvent a leopard than a tiger. The latter seldom or never looks upwards to the trees, therefore it does not perceive the hidden danger when the hunter is watching from his elevated post; but the leopard approaches its 'kill' in the most wary and cautious manner, crouching occasionally, and examining every yard of the ground before it, at the same time scanning the overhanging boughs, which it so frequently seeks as a place of refuge. Upon many occasions, when the disappointed watcher imagines that the leopard has forsaken its 'kill,' and that his patience will not be unrewarded, the animal may be closely scanning him from the dense bush, under cover of which it was noiselessly approaching. In such a case the leopard would retreat as silently as it had advanced, and the watcher would return home from a fruitless vigil, under the impression that the animal had

never been within a mile of his position. . . . There is very little sport afforded by this stealthy animal, and it is almost useless to organise a special hunt, as it is impossible to form any correct opinion respecting its locality after it has killed an animal. It may either be asleep in some distant ravine, or among the giant branches of some old tree, or beneath the rocks of some adjacent hill, or retired within a cave, but it has no special character or custom that would guide the hunter in arranging a beat according to the usual rules in the case of tigers."

Leopards are, however, much less suspicious of traps than are tigers, and still more so than lions, and, accordingly, a large number are thus caught. In India they are frequently taken alive in the cage-trap, to which we have already referred under the head of the tiger: such traps being generally baited with a dog, goat, or calf, which attracts the leopard by its cries. In Africa a trap like a large fox-trap is, however, generally employed; and so bold in some parts are leopards that Mr. Hunter states that once during dinner-time he caught one in a trap which was set within fifteen yards' distance of the table at which he was sitting.



THE SNOW-LEOPARD ($\frac{1}{2}$ nat. sz)

THE SNOW-LEOPARD, OR OUNCE (*Felis*

The snow-leopard, or ounce, has been known to science for more than a century, but its habitat was long a mystery. This splendid animal is nearly allied to the leopard, from which it differs in the more arched form of the skull, as well as in coloration and its much longer fur. The long fur is thick, and almost of a woolly nature: the ground-colour of the upper-parts being a pale whitish-grey, occasionally with a faint yellow tinge, passing into pure white beneath. The black spots are much larger than those of the leopard, and over the greater part of the skin form

irregular rosettes, with the central area of each generally rather darker than the ground-colour of the fur. As in the leopard, the spots on the head, the lower portions of the limbs, and the extremity of the tail have no light-coloured centres. A black streak extends from near the middle of the back to the root of the tail. The tail itself is remarkable for the length of its fur, scarcely diminishing in diameter from root to tip. The length of a specimen noticed by Mr. Blanford was 7 feet 4 inches, of which 3 feet were occupied by the tail.

The snow-leopard inhabits the elevated regions of Central Asia. In Ladak it does not descend below the level of some nine thousand feet above the sea-level in winter, while in summer it ranges to a height of eighteen thousand feet and upwards; in the Gilgit district of the North-West Himalaya it is reported, however, by Dr. Scully to descend as low as six thousand feet in winter. The long and thick fur is specially adapted to protect the animal against the severe winter cold of the regions it inhabits. The beauty of the fur of a snow-leopard killed during the winter is unrivalled.

The northern range of the snow-leopard extends to the Altai Mountains and some distance beyond, while to the north-east it embraces Amurland and the Island of Saghalien. The animal is probably found all over Tibet, but how far to the westward of Gilgit it extends is at present unknown. It has, indeed, been reported from Persia and Armenia; but it has now been ascertained that, so far as the latter country at least is concerned, this is owing to the long-haired variety of the leopard referred to above having been mistaken for the ounce.

Our knowledge of the habits of the snow-leopard is at present but limited, since comparatively few Europeans have seen the animal in its wild state. From living in a practically treeless country, it is probable that it is unable to climb. It preys chiefly upon wild sheep, and goats, and marmots, and other Rodents; it wages war upon domestic sheep and goats when grazing upon the higher grounds; and it will likewise, it is said, occasionally attack ponies. It is reported never to molest man. The writer once saw a snow-leopard in Ladak at a considerable distance. Only one living example of this animal has hitherto been brought to England. This was a young one, believed to have come from Bhutan, which was purchased by the Zoological Society in 1891, but did not long survive its arrival.

THE JAGUAR (*Felis onca*).

The jaguar is the largest representative of the Cat family inhabiting the New World, being somewhat superior in size to the leopard, and having a relatively larger head. It agrees with the two preceding species in the ornamentation of the fur taking the form of large rosette-like dark spots, enclosing lighter centres; and likewise in the circular form of the pupil of the eye. The spots are, however, considerably larger than in the leopard; the ring of each being usually formed of a number of small spots, while the light centre of each rosette contains one or more spots. Moreover, the rosettes are arranged in from seven to eight longitudinal rows on each side of the body. The ground-colour of the fur is usually of a rich tan, the same tint obtaining in the middle of the rosettes. There is, however, a

considerable amount of individual variation in the general colour, and also in the arrangement of the spots. Examples from the more southern portions of the animal's range are stated to tend to a more yellow hue, sometimes becoming almost white; while in the region of the Orinoco there is, according to Humboldt, a darker variety, in which the dark brown fur is marked with scarcely distinguishable black spots, and some individuals are completely black. A variety from Mexico is characterised by the distance at which the small spots which ordinarily constitute the rings are placed from one another, so that complete rings or rosettes of spots only occasionally occur.

The skull may be distinguished at a glance from that of any of the other large cats by the presence of a well-marked tubercle near the middle of the inner side of the socket of the eye or orbit. The total average length of the jaguar may be set down at about 6 feet 2 inches, of which the tail occupies 2 feet 1 inch, equal to about a third the length of the head and body. A large example measured by the naturalist Azara had, however, a total length of 6 feet 9 inches, of which the tail occupied 2 feet 2 inches: while a still larger specimen is said to have measured upwards of 5 feet from the tip of the nose to the root of the tail. The range of the jaguar embraces the whole of the country lying between the north of Mexico and Texas and the northern parts of Patagonia: its southern limit coinciding approximately with the fortieth parallel of south latitude.

The jaguar is one of the most expert climbers among the larger cats: and it is stated by Humboldt, on the authority of the natives, that in certain districts of South America, where the forests are subject to inundation, and the trees stand so thickly that the passage from one to another is perfectly easy, the jaguar will sometimes take to an arboreal life, preying upon the troops of monkeys that inhabit the forests. All writers are agreed as to its ferocious nature and likewise as to its noisiness, Humboldt speaking very feelingly as to the loudness and frequency of its cries; but there is no record of its having attacked human beings without provocation.

Darwin states that in the forest districts of South America its favourite haunts are the wooded banks of rivers and the reed-clad margins of lakes. And it appears that in general the neighbourhood of water is as essential to its well-being as it is to that of the tiger. But in the pampas of Argentina the jaguar inhabits a district where water is scarce, and where trees are practically unknown: and it is, evidently capable of modifying its habits to a considerable extent in accordance with its surroundings. Writing of its occurrence in the pampas, Mr. W. H. Hudson, in his charming work, *The Naturalist in La Plata*, observes that probably only an extreme abundance of Mammalian prey, which has not existed in recent times, could have tempted an animal of the habits of the jaguar to colonise this cold, treeless, and comparatively waterless desert.

In the well-watered districts it is stated that the jaguar will sometimes prey to a considerable extent upon fish: and Humboldt relates that it is partial to the eggs of the turtles which are so abundant on the Orinoco, and even to the turtles themselves, the flesh of which it scoops out with its paw from the shell. According to Darwin, in similar districts its common prey is the capybara, and when this animal is abundant, it seldom attacks any other. The mode of killing its

Referring to the habit of scoring the bark of trees with its claws, possessed by the jaguar in common with other cats, Darwin observes that, "one day when hunting on the Uruguay, I was shown certain trees to which these animals constantly repair, for the purpose, it is said, of sharpening their claws. I saw three well-known trees. In front the bark was worn smooth, as if by the breast of the animal, and on each side there were deep scratches, or rather grooves, extending in an oblique line, nearly a yard in length. The scars were of different ages. A common method of ascertaining whether a jaguar is in the neighbourhood, is by examining these trees. I imagine that this habit of the jaguar is exactly similar to that which may any day be seen in the common cat, as with outstretched leg and extended claws it scrapes the legs of a chair. Some such habit must also be common to the puma, for on the bare hard soil of Patagonia I have frequently seen scars so deep that no other animal could have made them. The object of this practice is, I believe, to tear off the ragged points of their claws, and not as the Guachos think, to sharpen them."

Like the other large cats, the jaguar takes to the water readily, and swims well. Its cry, which cannot be correctly described as a roar, is loud, deep, and hoarse, and has been compared to a series of repetitions of the syllables, *pu, pu, pu*. From two to four cubs are produced at a birth, which takes place about the end of the year. It is generally regarded as being of an utterly untamable disposition, even when captured young. Lady Florence Dixie succeeded, however, in rendering one of these animals perfectly docile, and even affectionate.

A peculiar animosity to the jaguar is displayed in the pampas by its near relative the puma, Mr. Hudson observing that, "it is well known that where the two species inhabit the same district they are at enmity, the puma being the persistent persecutor of the jaguar, following and harassing it as a tyrant-bird harasses an eagle or hawk, moving about it with such rapidity as to confuse it, and, when an opportunity occurs, springing upon its back, and inflicting terrible wounds with teeth and claws. Jaguars with scarred backs are frequently killed, and others, not long escaped from their tormentors, have been easily overcome by the hunters." This is the more remarkable since the puma is an animal of far

inferior size and power to its adversary, although what it lacks in power it makes up in agility.

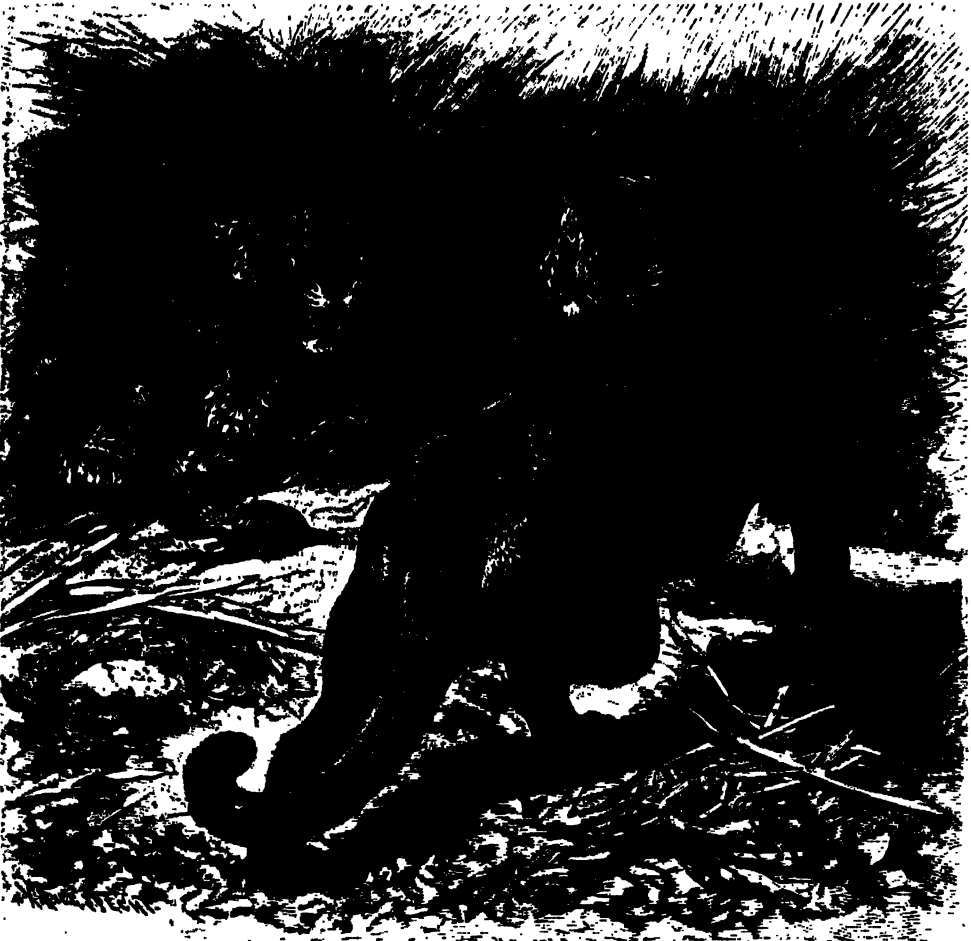
The Guachos of South America are in the habit of capturing the jaguar with the lasso; and Mr. Hudson relates a curious instance of how one of these fierce animals was absolutely paralysed with fear, induced by a party of hunters who intended to capture it in this manner. These hunters had started the jaguar in an outlying district of the pampas, and it had taken refuge in a dense clump of dry reeds. "Though they could see it," writes Mr. Hudson, "it was impossible to throw the lasso over its head, and after vainly trying to dislodge it, they at length set fire to the reeds. Still it refused to stir, but lay with head erect, fiercely glaring at them through the flames. Finally it disappeared from sight in the black smoke; and when the fire had burnt itself out, it was found dead and charred in the same spot." Similarly, Livingstone relates how one of the harnessed antelopes of South Africa will lie close among burning reeds until its horns and hair are singed: both these instances being examples of the paralysing effects of fear, analogous to that which causes a wolf when caught in a pit to lie perfectly still, even under the infliction of severe blows, as if simulating death.

Finally, it may be mentioned that, with the usual propensity for applying Old World names to New World animals and places, the jaguar is commonly known to the European inhabitants of South America as the tiger.

THE PUMA (*Felis concolor*).

As the jaguar in America usurps the name of the tiger, so its compatriot the puma is generally known there either as the lion, or the panther, or, as corrupted, *painter*. The animal is also known, more especially in works of natural history, as the couguar or cougar, which was abbreviated by the French naturalist Buffon from the Brazilian *caguacu-ara* or *caguacuariusua*. Puma appears to be the native Peruvian name, and is the one usually adopted by English-speaking zoologists. Next to the jaguar, the puma is the largest of the American cats; and it is the only large unspotted representative of the genus in the Western Hemisphere. From its extensive geographical range, the puma, as Mr. F. W. True well remarks, may be regarded as the most characteristic mammal of America. In form, it is distinguished by the great relative length of the body, and the lithe build. The general colour of its fur is a uniform tawny, passing into whitish on the under-parts of the body: but there is a darker streak running along the middle of the back, and the extremity of the tail is dusky brown. The outer surfaces of the ears are black, with a whitish area near the middle; while the white upper lip is characterised by the presence of a conspicuous black spot in the middle line. In marked contrast to the black nostrils of the other large cats, those of the puma are flesh-coloured. Such is the general coloration, but it has been observed that, at least in North America, there is a seasonal variation in the colour of the fur, which assumes in summer a redder, and in winter a greyer tint. There is, moreover, considerable individual variation in this respect; but it does not appear that there is any constant difference dependent upon locality. Thus individuals of a yellowish-grey and yellowish-brown colour are not uncommon, while much more rarely others

of a brown, and nearly, if not quite, black hue are sometimes met with. Others, again, may be nearly white; and it is stated that albino pumas have been found in the Alleghany Mountains and New Mexico, but Mr. True, who has done so much to advance our knowledge of the species, states that this is not authenticated. Somewhat curiously, it does not appear that the pelage of the puma varies in the



nat.

length of the fur according to the temperature of the regions it inhabits, the animal being in this respect unlike the tiger.

The colour of young puma cubs is very different from that of the adult, the fur on the body and limbs being marked with large blackish-brown spots, while the tail is ringed with the same colour. These spots and rings remain more or less distinct till the cubs are about six months old, when they disappear to a greater or smaller extent, although they can generally be traced till the animal is mature, and may in some instances, especially when the fur is viewed in certain lights, continue through life. The presence of these spots in puma cubs is important, as

showing that the uniform coloration of the adult is an acquired feature, and that the ancestors of the species were doubtless spotted at all ages.

In regard to the dimensions of the puma, it is stated by Mr. True that a male preserved in the museum at Washington has a total length (measured along the curves of the body) of 6 feet 7½ inches, of which 2 feet 2½ inches are occupied by the tail. A large male killed in Arizona measured 7 feet in total length, of which 3 feet was occupied by the tail; while a smaller male from the same locality had a total length of only 6 feet, of which the tail took up 1 foot 11 inches. The largest individual of which the measurements can be regarded as authenticated was one killed in Texas in the year 1846, of which the total length was 8 feet 2 inches, the length of the tail being 3 feet 1 inch. It is stated that a stuffed specimen measures 9 feet 1 inch in total length, while Mr. W. A. Perry considers that the length may in some instances be as much as 11 feet, which appears, however, somewhat improbable.

The geographical range of the puma in latitude is probably greater than that of any other Mammal, extending from New England and British Columbia in the north, to the extreme end of Patagonia in the south; while Mr. W. H. Hudson is of opinion that it has also occurred in Tierra del Fuego. According to Mr. True, in North America it does not even appear to have been met with in the states of New Hampshire, Rhode Island, New Jersey, or Delaware, on the Atlantic coast, nor in Michigan or Indiana in the north. Another recent writer states that it is still abundant in Northern California, Oregon, Washington, British Columbia, and Alaska, and that it is most numerously represented in northern Washington, where it attains its largest size, and where the abundance of deer, grouse, and rabbits, and also of fish in the rivers, afford it an inexhaustible supply of food. In Ohio the puma was exterminated previously to the year 1838, while it appears to have become more recently extinct in the states of Illinois and Indiana. Like many of the other wild animals of the United States, the puma is rapidly retreating before the advance of civilisation and cultivation, and it is probable, as Mr. True remarks, that in several of the more thickly-populated states not even stragglers now remain. In South America it appears to be abundant both in the forest districts of the great rivers, and likewise on the desert pampas; and in the latter area it largely exceeds the jaguar in numbers.

As might have been predicted from its immense geographical range, the puma is remarkable for its power of adapting itself to different climatic conditions and external surroundings. For instance, in the Adirondack Mountains, near New York, where it is now nearly exterminated, the puma has to withstand a severe winter cold, during which it has to track its prey in the snow; and this is also still more markedly the case in the regions near the northern limits of its range. On the other hand, the animal is equally at home in the hot and fetid swamps and cane-brakes bordering the rivers of the southern United States, while in South America it is to be found alike on the treeless grassy pampas of Argentina and in the forests of the Amazon. Then, again, in the Rocky Mountains, it is stated, on the authority of Mr. W. T. Hornaday, that the puma will ascend to the high elevations inhabited by the bighorn sheep, and its tracks have been observed on the summit of Mount Persephone in California, at a height of three thousand feet above the

sea-level, and in the Chilian Cordillera at an elevation of not less than ten thousand feet. In the Peruvian highlands the puma is also found in the highest forests, and even occasionally ascends to the limits of perpetual snow, while in the dense mountain-forests of Central America it is commonly found as high up as eight or nine thousand feet.

As a rule, throughout the widely different regions included in its range, the puma selects for its lair localities affording a certain amount of concealment and protection, usually preferring thickets and copses to dense forests. In Mexico it has been observed that these animals are always met with in the most solitary spots, especially such as have a cover of thick bushes, or where there are rocks with caves. In the pampas of Argentina the puma probably has to make the best of the cover afforded by the tussocks of tall grass, or by the banks of the river-courses.

In respect of the daring, or otherwise, of the puma, there is a considerable amount of discrepancy in the accounts of different writers. It is, however, probable that this diversity of view is mainly owing to the general refusal of the creature to attack human beings having been regarded as indicative of its general character, although diversity of habit in the southern and northern portion of its range is probably also in some degree a factor in the case. Writing of the animal's habits in South America, Mr. Hudson observes that, although the puma is undoubtedly possessed of marvellous courage and daring, yet the account given long ago by the naturalist Azara, that it will never attack or threaten to hurt either man or child, even when found asleep, is not only true, but actually understated. As a matter of fact, not only will the puma refrain from attacking man, but it will not even defend itself against him. It is from this circumstance that, in South America at any rate, the puma has earned its reputation for arrant cowardice. That it is in other respects a bold animal in South America Mr. Hudson unhesitatingly asserts, and he backs this opinion by stating that the puma invariably prefers large to small game, in desert regions killing peccaries, tapirs, deer, huanacos, rheas, etc. The number of huanacos killed by pumas in Argentina is attested by the number of their skeletons found on the pampas with dislocated necks, while, except in regions where prey is scarce, the number of slaughtered deer, with only the flesh of the breast eaten, shows the puma's fastidious habits. Those, observes Mr. Hudson, who have ever hunted the huanaco on the sterile plains and mountains know how wary and keen-scented it is, and consequently what powers of endurance and skill its pursuit must entail on the part of the pursuer.

In the parts of South America where cattle and horses are largely bred the puma is a terrible scourge. Indeed, so partial is it to horse-flesh, that in some parts of Patagonia it is almost impossible to breed horses owing to the destruction of their colts. An instance is related of a puma springing on a colt among a drove in charge of a driver, and killing it so suddenly by dislocation of the neck that the unfortunate animal was actually dead before it fell to the ground. It further appears that in districts where pumas abound the semi-wild horses of South America can scarcely maintain their existence, owing to the slaughter of their colts; and this leads Mr. Hudson to suggest that the indigenous horses, which inhabited South America during the Pleistocene epoch, may have been totally exterminated by pumas. The puma does not, however, confine its ravages on horses to the

colts, but will also attack and kill full-grown adults. The same is true for cattle, among which calves more generally, and cows rarely, fall victims to the puma's rapacity. Horned cattle are, however, less preferred than sheep, which, next to horse-flesh, form its favourite food in pastoral districts. Indeed, so partial are pumas to mutton, that one has been known to make use of a calf-pen as a place of concealment from which to raid on a sheep-fold, passing through the former without offering to molest its tenants.

The acme of daring on the part of the South American puma is, however, reached in the attacks which it makes upon the jaguar, to which allusion has been made when treating of the latter animal; and it appears that in North America the puma exhibits an equally marked hostility to the grizzly bear. In these respects the puma is undoubtedly entitled to be regarded as one of the boldest and fiercest of Carnivores in proportion to its size.

In regard to its gentleness towards the human race, it appears that so well known is this trait to the Guachos of the pampas as to have led them to apply to it the title of *amigo del cristiano*; and it is notorious that in places where pumas abound it is perfectly safe for a child to wander alone, and even sleep, on the pampas. A traveller on foot on the pampas, who was compelled by stress of circumstances to make his nightly resting-place beneath the shelter of a rock, related to Mr. Hudson how that on one occasion four pumas, the two parents and their young, appeared as he was resting during the early part of a moonlight night. "Not feeling the least alarm at their presence, he did not stir; and after a while they began to gambol close to him, concealing themselves from each other among the rocks, just as kittens do, and frequently while pursuing one another leaping over him. He continued watching them till past midnight, when they had left him." The same traveller also related to Mr. Hudson how he had once, and once only, killed a puma, adding that nothing would induce him to kill another. On the occasion referred to a puma was found, which sat perfectly still with its back against a stone, not even moving when lassoed. "My informant," writes Mr. Hudson, "then dismounted, and drawing his knife, advanced to kill it: still the puma made no attempt to free itself from the lasso, but it seemed to know, he said, what was coming, for it began to tremble, the tears ran from its eyes, and it whined in the most pitiful manner. He killed it as it sat there unresisting before him; but, after accomplishing the deed, felt that he had committed a murder." If this were an isolated case, it would not be of much importance, but scores of instances attest that this strange and inexplicable behaviour is characteristic of the South American puma, and that it almost invariably resigns itself to death in this unresisting manner. Very different is, however, the behaviour of the puma when attacked by a hunter accompanied by dogs. At such times, the animal is roused to the fiercest paroxysms of rage: and with hair erect and eyes flashing like balls of lurid fire, it rushes spitting and snarling on the dogs, utterly regardless of the presence of the hunter. So thoroughly indeed is the hunter ignored on such occasions, that he may actually belabour the puma on the head with a cudgel without drawing its attack upon himself: the animal receiving such blows without retaliation, and calmly waiting its opportunity of making a rush upon the dogs. Dogs seem, indeed, invariably to excite the puma to uncontrollable bursts of passion; and an

instance is on record where one of these animals, when taken out of its cage and led by a chain, walked peaceably in front of a crowd of spectators, until, on catching sight of a dog, it suddenly broke away from control, and dashed violently among the people, who scattered in all directions.

One of the few instances known to Mr. Hudson, where a puma in South America has defended itself against a human being, was related to him by a Guacho. This individual, after an unsuccessful encounter with a jaguar, was riding on the pampus when "a puma started up from the long grass in his path, but made no attempt to run away; it merely sat up, he said, and looked at him in a provokingly fearless manner. To slay this animal with his knife, and so revenge himself for the defeat he had just suffered, was his first thought. He alighted and secured his horse by tying its fore-feet together, then, drawing his long heavy knife, rushed at the puma. Still it did not stir. Raising his weapon he struck with a force which would have split the animal's skull open if the blow had fallen where it was intended to fall, but with a quick movement the puma avoided it, and at the same time lifted a foot and with lightning rapidity dealt the aggressor a blow on the face, its unsheathed-claws literally dragging down the flesh from his cheek, leaving the bone bare. After inflicting this terrible punishment, and eyeing its fallen foe for a few seconds, it trotted quietly away." Eventually the wounded man recovered from his injuries.

As a culmination to its generally harmless character where man is concerned, there are stories current to the effect that the puma in South America will actually guard human beings when threatened with attack by other animals. Such an instance is related by Mr. Hudson, where a puma having placed itself by the side of a belated traveller on the pampus, attacked and drove off a jaguar, and this more than once. The narrator believes this anecdote to be strictly true, and remarks that the fact of a puma never making an unprovoked attack on man, and but rarely resisting him when attacked, is not really less wonderful than that it should follow him and come near him when alone in the wilderness, and even occasionally defend him from the jaguar, the common enemy of both.

Turning to North America, we find very similar accounts to those related above as to the serious injuries inflicted by pumas in the less settled districts on live stock. Thus in Mexico they are reported to kill large numbers of colts and calves, and on this account are poisoned by the herdsmen with strychnine. In California it is stated to be impossible to breed horses in one district, on account of the ravages of these pests; and the destruction inflicted by them on calves and pigs is also considerable.

With regard to the behaviour of the puma towards man, and its courage (or the reverse) in North America, the accounts to hand are not so circumstantial and definite as might be desired. All authorities are, however, agreed that it does not ordinarily attack human beings, and that when surprised it generally endeavours to make good its escape. Nevertheless, there are several instances on record where pumas have made such attacks, even in open daylight; among these we select two quoted by Mr. Perry. One case occurred in the spring 1886, when some children from Olympia, Washington, were returning home from school. The eldest, a boy of twelve, noticed something that he thought was a large yellow dog, trotting on

the road behind them. They paid no attention to it, as large mongrel dogs of this colour abound everywhere in the vicinity of the Indian camps, but played leisurely along, as is the custom of children the world over. The youngest boy, a chubby little chap of six summers, who was behind his brothers, suddenly came rolling along in front of his brothers, and a moment later the great cat sprang over the heads of the two astonished boys, seized the little fellow in its mouth, and with a spring vanished from sight in the bushes. Mr. Perry proceeds to relate how the eldest brother, with nothing but an empty bottle, proceeded into the wood and heroically rescued the child, by beating the puma about the head until the bottle was smashed to atoms, and then attempting to gouge out the creature's eyes with the broken edges of the neck. The second instance occurred to a Swedish sailor named Joseph Jorgenson, in British Columbia. "The man had just commenced to clear a spot in the forest for the purpose of building a house, and was wielding his spade vigorously when suddenly his arm was seized as in a vice. He wheeled instantly, and found that his arm was in the jaws of a cougar. He was a young and powerful man, . . . so, without any preliminaries, he dealt his assailant such a kick in the stomach as to break its hold on his arm, and to lay it prostrate at his feet. The cougar instantly resented this rude treatment. Crouching it sprang at its foe's throat, but he warded its head from his throat with his left arm, while with his right he dealt it a blow in the ribs that again prostrated it at his side. Quick as a flash it returned to the attack and seized him by the left hand, driving its fangs through the flesh and fearfully lacerating it. It was a fight for life, and Joe, with his brawny fists and heavy boots, beat and kicked the animal with such force that it released its grip on his hand and retired a short distance. Then it crouched and sprang at him again, landing on his breast and knocking him heavily against a tree: but again he cuffed and kicked it, until it again retreated and crouched for another spring. Fortunately Joe looking down saw the spade he had been using lying at his feet. Stooping quickly he grasped it just in time to ward off the cougar's spring by giving it a thrust with the spade. The brute fell at his feet, but instantly rose and seized him by the thigh. Maddened with pain, Joe made a gladiatorial thrust at the cougar's head. The sharp blade of the spade went crashing through its skull, and it fell dead at his feet."

To these instances of unprovoked attacks it may be added that the North American puma when attacked by man does not appear ever to exhibit that passive non-resistance which is its most remarkable trait in South America. At the time when pumas were abundant in the Adirondack Mountains, they were hunted in the snow during the depth of winter, when the hunter, in his snowshoes, made side circuits until he hit off a trail. Generally such a track led to the carcass of a deer recently killed and partially eaten. And here it may be remarked that in regard to their prey the Adirondack pumas differ from those of Argentina, in that, at least in winter, they will return again and again to a "kill," until the carcass is nearly or completely devoured. This may, however, be due to the circumstance that while in the hot plains of the Argentine the flesh of a slain animal would soon become tainted, it would remain fresh for a long period among the snows of the Adirondacks.

When such a "kill" is found the hunter looses his dogs, who soon succeed

in finding the puma, which generally takes to a tree, but will occasionally stand at bay on the ground. "When attacked," writes Dr. Hart Merriam, who derives much of his information from a Mr. Sheppard, "they never spring after the dogs, but merely act on the defensive. When a dog makes bold to come too near, he receives such an energetic 'cuff' from the puma's¹ paw, that he rarely solicits another. Though possessed of great strength and power, and naturally quick in his movements, the puma is a positive coward. For all that, when seriously wounded, without being entirely crippled, all his latent ferocity is aroused, and he rushes fiercely at his assailants. But even at such times, when in an attitude of supreme anger and rage, and while lashing the snow impetuously with his long tail, anything thrust into his open mouth serves to divert his wrath from the enemy to his weapon. Thus on two occasions, once with an axe and once with the muzzle of his gun, has Mr. Sheppard saved himself and his dogs from mutilation, if not from a horrible death." From this it would appear that the Adirondack puma has not that intense antipathy to dogs which causes its Argentine cousin to rush on them with such ferocity. Whether the charge of arrant cowardice brought against the northern puma by Dr. Merriam is not partially due to some remnant of the passiveness exhibited by the southern form when attacked by man, is a question which may admit of argument.

We have already mentioned that in the wilder parts of South America, where domesticated animals are not obtainable, a large proportion of the food of the puma is formed by huanaes and deer, while in the northern part of its range deer are the only large animals preyed upon. It must not, however, be considered that the flesh of such animals forms in all cases the chief portion of the puma's diet. Thus, in the dense forests of the Amazon and Orinoco, where several Carnivores tend to assume more or less completely arboreal habits, it is related that pumas have been seen to chase monkeys from bough to bough, and from tree to tree; and it would thus seem that the flesh of the latter constitutes a considerable proportion of the food of the puma in those regions. Strange as it may at first sight appear, the pumas of the Adirondacks were wont to prey largely upon the porcupines which are found in abundance in that wilderness, and individuals were frequently killed with their mouths and lips, and sometimes other portions of their bodies, absolutely bristling with the quills of porcupines. Whether, however, these animals were selected as an article of food from choice, or whether the pumas were driven to devour them from inability to capture other prey, is uncertain. Be this as it may, porcupines are creatures which, from their sluggish habits and contempt of ordinary foes, may be easily captured, and would be sure to come in the way of the puma during its nocturnal wanderings. Mr. Perry states that the North American puma will eat almost anything, from deer down to rats, mice, fish, and even snails. In the pampas of South America the puma, in addition to the larger animals already mentioned, is stated to prey upon large Rodents like the aguti and the paca, and likewise upon the coati, while it is also said to kill and eat the noisome skunk. The rhea, or South American ostrich, is also at times hunted by the puma on the pampas, while in New Mexico and Arizona, according to Messrs Coues and Yarrow, so severely are the wild turkeys persecuted by it that many hundreds are killed

¹ In quoting from Dr. Merriam we have ventured to substitute the name puma for panther.

annually, and several of their old breeding-places have become completely deserted. When extremely hard pressed by hunger, the puma is said not even to disdain a meal of carrion.

Like most of the larger felines, the puma seeks its prey mainly by night and during the morning and evening twilights, but it hunts occasionally by day. Deer are stalked after the usual stealthy manner of the cat tribe, and when approached within striking distance are rushed upon in a series of successive leaps, unless, indeed, the puma can spring upon them from an elevation, when a single leap will suffice. If not caught within a few leaps, the deer commonly escapes, as its foe then gives up the chase. The leaping powers of the puma are prodigious, and it is said that when pursued by dogs it has been known to spring upwards and reach a bough at a height of twenty feet from the ground, while horizontal leaps of the same distance are by no means uncommon, and an instance is on record where the length of a leap on snow was close upon forty feet. Authorities are now generally agreed that the puma kills the larger animals by springing upon their shoulders and dislocating the neck. In the northern portions of its range during the winter the puma will on occasions pursue deer for long distances when they are incapable of rapid flight owing to the depth of snow on the ground.

The number of young produced at a birth varies from one to four or five; but apparently two is the ordinary number, more especially when in captivity. In the Adirondacks, according to Dr. Merriam, the young are born towards the close of winter or the beginning of spring, the lair being usually situated in a shallow cave on the face of a steep cliff or ledge of rock. And it would appear that in the same district the female does not give birth to offspring more frequently than every other year. In the southern portions of the United States, where caves and rocks are wanting, Audubon states that the lair is made in a dense thicket or cane-brake, and constructed of twigs, leaves, and moss, with an overarching roof of evergreen canes, which forms an efficient protection against rain at all seasons of the year. The young when first born are from 10 to 12 inches in length; they open their eyes at the ninth or tenth day. The age which the puma attains is not yet ascertained, but one kept at Frankfort for sixteen years died from an accident while in full health and vigour.

Although the works of the older writers abound with references to the piercing cries and startling screams of the puma, it would seem that in general the animal is silent. Darwin states that in South America the only occasion on which it utters any sound is during the breeding-season, and even then but rarely, while, when wounded, it always remains silent. From accounts given him by the hunters of the Adirondacks, Dr. Merriam came to the conclusion that the screams of the puma were a total myth, the cries which have been attributed to it being uttered by other animals. Against this, it may be observed that Messrs Kennerby and Schott, when surveying in Mexico in 1858, state that on more than one occasion they heard loud cries which they attributed (on what evidence does not appear) to the puma. Moreover, Dr. J. A. Allen in Colorado, and Mr. D. G. Eliot in Florida, speak of having heard the puma's cry, although the latter writer, at any rate, did not see the animal. More important is the observation recorded by Mr. Schott to the effect that a puma killed on the Rio Bravo, between Fort Duncan and Laredo, "during

of the head and the limbs are ornamented with spots; while the tail has a number of dusky rings, which are not infrequently incomplete. The skull may be recognised by its low and elongated form; as well as by the great relative length of the upper tusks, or canine teeth, which are proportionately longer than in any other living species of cat.

In size the clouded leopard may be compared to a small individual of a true leopard. One male measured 5 feet 7½ inches in total length, of which 2 feet 6 inches were taken up by the tail; while another reached 6½ feet, of which 3 feet were occupied by the tail. The length of the tail in these specimens is thus about equal to four-fifths of that of the head and body, but there is a variety from the Island of Formosa in which the tail is much shorter.

The clouded leopard is confined to the south-eastern parts of Asia, ranging from the Eastern Himalaya, in the districts of Bhutan and Sikkim, to Assam, and thence to Burma, the Malay Peninsula, and the islands of Borneo, Sumatra, and Java. The short-tailed variety, found only in the Island of Formosa, probably indicates that the distribution of the series on the mainland of Asia was formerly more extensive than at present.

To the Malays the clouded leopard is known as the Rimau-dahan, or Arimau-dahan, meaning the tiger of the trees; the word *dahan* signifying the forked branch of a tree. According to Mr. Blanford, the whole of our limited knowledge of the habits of this species is derived from the reports of native hunters, and is not, therefore, in all respects trustworthy. That it passes almost the whole of its time in trees, on the branches of which it sleeps, is, however, thoroughly ascertained; and it appears that its food consists chiefly of birds and small mammals.

THE MARBLED CAT (*Felis marmorata*).

The marbled cat from the Eastern Himalaya, Assam, Burma, and the Malayan region, is a much smaller species, agreeing in the general character of its markings with the clouded leopard. In size this beautiful little species is somewhat larger than a domestic cat of average dimensions; the length of the head and body, according to Mr. Blanford, varying from 18½ to 23 inches, and that of the tail from 14 to 15½ inches. The fur is characterised by its thickness and softness; and in Himalayan specimens, at least, has an under fur of a woolly nature.

From the resemblance of its coloration to that of the clouded leopard (in which the marbled fur harmonises with the gnarled and knotted boughs on which the animal reposes), it may be inferred that the marbled cat is likewise an arboreal species. It is figured on the opposite page.

The Tibet cat (*Felis scripta*), from Eastern Tibet, is another small-sized species allied in coloration to the clouded leopard.

THE GOLDEN CAT (*Felis temminckii*).

The golden or bay cat is a well-marked Indian species, of somewhat inferior dimensions to the clouded leopard, and readily distinguished by its deep ferruginous or chestnut colour, which passes into bay along the line of the back: the under-

parts and chin, as well as the lower surface of the tail, being whitish or white. There are some dark spots on the chest, while the face has some characteristic but variable markings.

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THE MARBLED CAT ($\frac{1}{2}$ nat. size).

extends northwards into Tibet: while in the opposite direction its range embraces Burma, and a considerable part of the Malayan region, although its exact limits are unknown. Nothing is known as to the habits of this cat, but from its coloration it would appear probable that it frequents sandy or rocky districts.

THE FISHING-CAT (*Felis viverrina*).

The fishing-cat of India, which is somewhat larger than the ordinary domestic cat, derives its name from its peculiar habit of living to a great extent upon fish, which it captures for itself. This species is a short-limbed, spotted cat, with a circular pupil to the eye, the tail about equal in length to one-third the length of the head, and the short and coarse fur lacking the beautiful shining gloss characteristic of most of the other members of the family. The head is somewhat elongated, and the ears are short and rounded. The general ground-colour of the

his struggle with the hunters and dogs raised a terrible cry, twice or thrice, to express his rage, and perhaps also to give his family the notice of danger." It would seem, therefore, that, although generally a silent creature, the puma may on rare occasions—and more especially when wounded—give vent to a cry or scream, which is described as being of the most weird and unearthly nature.

When captured young, pumas thrive well in captivity, and are gentle and affectionate in disposition towards human beings, although they but rarely overcome their innate antipathy to dogs. If, however, not taken till adult, they appear in all cases to pine and languish. Mr. Hudson writes that "the puma is, with the exception of some monkeys, the most playful animal in existence. The young of all the *Felidae* spend a large portion of their time in characteristic gambols. The adults, however, acquire a grave and dignified demeanour, only the female playing on occasions with her offspring, but this she always does with a certain formality of manner, as if the relaxation were indulged in not spontaneously but for the sake of the young, and as being a necessary part of their education. . . . The puma at heart is always a kitten, taking unmeasured delight in its frolics: and when, as often happens, one lives alone in the desert, it will amuse itself by the hour fighting mock battles, or playing at hide-and-seek with imaginary companions, and lying in wait and putting all its wonderful strategy in practice to capture a passing butterfly. Azara kept a young male for four months, which spent its whole time playing with the slaves. This animal, he says, would not refuse any food offered to it; but when not hungry it would bury the meat in the sand, and when inclined to eat it would dig it up, and, taking it to the water-trough, wash it clean. I have only known one puma kept as a pet, and this animal, in seven or eight years, had never shown a trace of ill-temper. When approached, he would lie down, purring loudly, and twist himself about a person's legs, begging to be caressed. A string or handkerchief drawn about was sufficient to keep him in a happy state of excitement for an hour, and when one person was tired of playing with him he was ready for a game with the next comer."

A tame puma, of which the skeleton is now preserved in the Museum of the Royal College of Surgeons, was kept as a pet by Edmund Kean, the actor. It would follow its master loose, like a dog, and was often brought into his drawing-room when visitors were present. Jardine, writing of this animal, states that it was extremely gentle and playful, and showed no symptoms of ferocity to the strangers who came to see it. Its motions were all free and graceful, and it exhibited the greatest agility in leaping and swinging about the joists of a large unoccupied room in the old college of Edinburgh.

Fossil remains of the puma have been found in the superficial deposits of several districts in the United States which probably belong to the Pleistocene period. It may also be mentioned that fossil bones of the jaguar occur in the celebrated caverns of Lagoa Santa, in Brazil, in company with those of a number of gigantic extinct Mammals. Both these cats are, therefore, comparatively old species.

THE CLOUDED LEOPARD ($\frac{1}{10}$ nat. s.)THE CLOUDED LEOPARD (*Felis*

With the clouded leopard, or, as it is often less appropriately called, the clouded tiger, we revert to the cats of the Old World. This handsomely-coloured animal, which may be regarded as the last of the very large cats, is a long-bodied and short-legged species, usually provided with a very long tail, and of thoroughly arboreal habits. The head is of a more elongated form than in any of the species yet noticed; while the pupil of the eye is oval, with its longer diameter vertical. The ground-colour of the fur varies from greyish to yellowish-brown, passing into whitish beneath; the markings on the body taking the form of narrow vertical stripes and blotches of black, which form large irregularly arranged patches. On the sides of the face there are always two distinct black stripes, arising respectively from behind the eye, and from above the angle of the mouth; of which the former extends behind the ears to join the black markings of the back. The upper-parts

¹ Also known as *F. macrotis* and *F. diardi*.

of the head and the limbs are ornamented with spots; while the tail has a number of dusky rings, which are not infrequently incomplete. The skull may be recognised by its low and elongated form; as well as by the great relative length of the upper tusks, or canine teeth, which are proportionately longer than in any other living species of cat.

In size the clouded leopard may be compared to a small individual of a true leopard. One male measured 5 feet 7½ inches in total length, of which 2 feet 6 inches were taken up by the tail; while another reached 6½ feet, of which 3 feet were occupied by the tail. The length of the tail in these specimens is thus about equal to four-fifths of that of the head and body, but there is a variety from the Island of Formosa in which the tail is much shorter.

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fur is usually some kind of grey, with a more or less brownish tinge; the back being darker and browner, and the under-parts, as usual, whitish. The spots, which may be either dark brown, or of a full black colour, have no light centres, and are always much longer than broad, although they are subject to considerable individual variations in shape and size; they cover the whole of the body. The head is marked by a number of longitudinal stripes, starting from the forehead and running to the nape of the neck; these becoming broken up on the shoulders, but reappearing along the back as a line of spots. The greyish-white cheeks are generally crossed by two dark streaks; and the limbs are usually barred and spotted, more especially on their outer sides, although occasionally uniformly coloured. The tail has its upper surface marked with more or less distinctly defined dark rings.



THE FISHING-CAT ($\frac{1}{2}$ nat. size).— After Wolf.

Altogether, the coloration of the fishing-cat reminds us of some varieties of the domestic "tabby."

A fair-sized male of the fishing-cat will have a total length of about $41\frac{1}{2}$ inches, of which the tail (the hair at its tip being included in the measurement) will take up about $11\frac{1}{2}$ inches. The height of such an animal at the shoulders will be about 15 inches.

The skull of the fishing-cat may be distinguished from that of any of the species yet mentioned by the circumstance that in fully adult individuals the socket of the eye is completely surrounded by bone in almost all cases. In this respect the skull resembles that of a monkey and differs from those of most other Carnivores, although a similar feature is displayed in the skulls of some of the other small Indian cats, and also in those of the ichneumons, noticed later on. We have occasionally seen the skull of an adult domestic cat, in which the bony ring behind the socket of the eye is almost complete.

The geographical range of the fishing-cat extends from India to Southern

China; but its distribution in the countries it inhabits appears to be somewhat local. Thus, instead of occurring all over India, this cat, according to Mr. Blanford, is unknown in the peninsula, except on part of the Malabar coast. It occurs, however, in Ceylon, and is found along the flanks of the Himalaya as far westward as the independent state of Nipal. Thence it extends into Burma, the Malay Peninsula, and the south of China; but, somewhat curiously, it appears to be absent from the great Malayan Islands, such as Sumatra and Borneo. The species is, however, said to reappear in the Island of Formosa; which, if confirmed, will show that its distribution will accord very closely with that of the clouded leopard.

This cat is found in the neighbourhood of thickets bordering lakes, swamps, and rivers, and is stated to be far from uncommon in the neighbourhood of Calcutta. It does not appear that it has been observed by any European in the act of catching the fish which form such a considerable portion of its diet, and an account of the mode in which the capture is effected would be of much interest. In addition to fish it has been stated on good authority that this cat is also a consumer of the large mollusks found so abundantly in the swamps of India, and one specimen is known to have eaten a snake. Probably, however, almost any kind of food is equally acceptable to the fishing-cat, which doubtless catches all the smaller animals that come within reach of its clutches. All writers who have seen it in the wild state bear testimony to the fierce and savage disposition of this species; and it is on record that it has been known to destroy not only sheep, calves, and dogs, but also to carry off native infants which have been left unguarded. In reference to these destructive habits, a correspondent, quoted by Mr. R. A. Sterndale, observes that the fishing-cat generally "takes up its quarters in low swampy jungle, where it often carries off calves, for which the leopard undeservedly gets credit. Lately, a couple of months ago, a pair of them at night broke into a matted house, and went off with a brace of ewes, which had half a dozen lambs between them. . . . I have caught this species in traps, and when let loose in an indigo-vat, with a miscellaneous pack of dogs, they have invariably fought hard. . . . Some years ago one got into my fowl-house at night, and just as I opened the door to enter it made a fierce jump at me from a perch on the opposite side." The most remarkable instance of the ferocity of this cat is, however, related by Blyth. In this case a newly-caught male of the fishing-cat was put into a cage separated by a thin partition from one containing a tame female leopard, which, although young, was about double the size of the fishing-cat. The latter succeeded, however, not only in breaking through the partition between the two cages, but in actually killing the leopard, although it made no attempt to eat its flesh.

THE LEOPARD-CAT (*Felis bengalensis*).

The pretty little cat from South-Eastern Asia, commonly known as the leopard-cat, is subject to such an extraordinary amount of individual variation in colour and markings that it has received no less than fifteen separate scientific names, such variations having been regarded as indicating distinct species.

In size it has been compared by Mr. Blanford to a rather small domestic

cat, with relatively longer legs. The pupil of the eye is circular in ordinary light, and the length of the tail usually varies from about one-third to rather less than one-half that of the head and body. Usually the head and body measure together from 24 to 26 inches, while the tail has a length of from 11 to 12 inches, or rather more. Although this species comes under the denomination of spotted cats, with the spots much longer than broad and without light centres, yet the amount of variation is so great that it is almost impossible to give a description that will hold good for all the varieties. The ground-colour of the upper-parts is, however, very generally some shade of pale tawny, varying from rufous to greyish; while the spots, which have a more or less marked tendency to form longitudinal lines, may be either wholly black, or partly black and partly brown. The spots extend over the under-



THE LEOPARD-CAT ($\frac{1}{2}$ nat. size).

parts and limbs and the upper part of the tail: although the tip of the tail is barred. Four distinct longitudinal stripes on the forehead give a characteristic physiognomy to the head, these stripes being generally continued in a more or less distinct manner along the back.

This cat is exclusively a forest-dwelling species, and is found in many parts of India, such as the outer Himalaya, as far westward as Simla, the greater part of Lower Bengal, the Western Ghats on the Bombay side of the peninsula, and the Wynnad and Travancore districts in Madras. According, however, to Mr. Blanford, it is probably unknown in Ceylon. Eastward of the Himalaya its range includes Assam, Burma, the Malay Peninsula, the southern part of China, and the islands of Borneo, Sumatra, and Java, as well as the Philippines.

It would be tedious to indicate the different varieties of this cat, but it may be observed that, according to the writer last mentioned, while one set of varieties are characterised by the tendency to a grey tinge in the ground-colour, others display

an equally marked inclination towards a rufous hue. Blyth states that some of the grey varieties are hybrids with the domestic cat.

Although invariably found in forest districts, the leopard-cat is not confined to the hills, as it occurs in the sandarbans of Bengal at the level of the sea. Its prey consists of small mammals and birds, and it is said to breed in the spring, when it produces from three to four kittens at a birth; the lair being generally in a cave or under an overhanging cliff. In spite of its small size, the leopard-cat is a ferocious and spiteful animal, in captivity generally keeping curled up during the daytime in a dark corner of its cage, instead of pacing up and down in the usual restless feline manner. Blyth, who was unusually successful in taming wild creatures, confesses to having utterly failed in all his efforts to conciliate the leopard-cat, and his experience is confirmed by most others who have had to do with the animal. Mr. Blanford states, however, that a specimen in the London Zoological Gardens appeared thoroughly tame, and would answer readily to the call of its keeper. The depredations of this cat appear to be conducted with great boldness, General McMaster stating that he saw one carry off a fowl nearly as large as itself, shaking it savagely meanwhile, and making a successful retreat, in spite of the abuse, uproar, and missiles which the theft caused.

THE SERVAL (*Felis serval*).

With the serval we come to a well-known African cat of much larger dimensions than either of the three preceding species. It is a spotted cat, easily recognised by the great length of its legs and the comparative shortness of its tail, which is considerably less than half the length of the head and body. The ground-colour of the fur is generally of a light tawny, becoming whitish beneath. The black spots are generally small and widely separated, but in the middle line of the back tend to run together in streaks. The cheeks and forehead lack the dark stripes found in so many of the smaller spotted cats, but there are two very characteristic horizontal black bands on the upper part of the inner surface of each fore-leg, by which a skin of this species may be recognised at a glance. The tail is ringed throughout with black, and has a tip of the same colour. In well-grown adult examples the total length may reach 4 feet 8 inches, of which 16 inches are occupied by the tail. This cat is found from one end of Africa to the other, but appears to be more common in the south than in the north. Its "leggy" build and poor coloration render the serval a by no means handsome representative of the family.

Owing to the general lack of attention paid to them by the majority of sportsmen and travellers, we have far less information as to the habits and mode of life of the smaller cats of Africa and South America than we possess with regard to those of India, where a host of careful observers have made us tolerably well acquainted with most of the Mammals in their wild state.

In East Africa, as we are informed by Mr. H. C. V. Hunter, the serval inhabits the grassy plains at the foot of Mount Kilima-njaro, where it is not uncommon. It also ranges to an elevation of five thousand feet or more on the flanks of the mountain. At that elevation a black specimen was obtained by Mr. Hunter, and, since the natives have a separate name for this black variety, it must be compara-

tively common. In a black skin from South Africa in the British Museum the spots are distinctly visible when the skin is viewed in certain lights.

Omitting mention of certain little-known species of cats from Western Africa, such as the golden-haired cat (*Felis rutila*) of Sierra Leone and the Gambia, the



THE SERVAL (½ nat. size).

grey African cat (*F. neglecta*) from the Gambia, and the servaline cat (*F. servalina*) from Sierra Leone, we proceed to the consideration of two small Asiatic species.

THE RUSTY-SPOTTED CAT (*Felis rubiginosa*).

It is somewhat remarkable that as India is inhabited by the two largest living representatives of the Cat family, so it also includes the smallest member of the group. The species which has the honour of occupying the latter position is the pretty little animal known as the rusty-spotted cat, which is of somewhat smaller dimensions than an average domestic cat. Its general ground-colour is ruddy-grey, passing into white below, while the body and limbs, but not the tail, are spotted.

In some examples, however, the red tinge is greatly developed at the expense of the grey. The individual hairs vary in colour in different portions of their length. The dark spots on the back and side are longer than broad, with a more or less marked tendency to arrange themselves in longitudinal lines, and the species derives both its popular and its scientific name from their general rusty-red hue. In the reddish variety, which is characteristic of Ceylon, the spots are, however, brownish-black. As in so many of the smaller Indian cats, the forehead is marked by longitudinal dark stripes, four in number, and there is also a stripe on each side of the face behind the eye. The species is quite peculiar among the spotted cats in having the tail without either spots or rings, its upper surface being of the same tint as the back, while the under-part is paler. In length the rusty-spotted cat varies from 16 to 18 inches from the tip of the snout to the root of the tail, the length of the tail being constantly $9\frac{1}{2}$ inches.

The skull agrees with that of the fishing-cat in having the sockets of the eyes completely surrounded by bone, but it is peculiar in that there are never more than two premolar teeth in the upper jaw, that is to say, there is only one of these teeth in advance of the flesh-tooth.

This cat inhabits Ceylon and Southern India, rarely extending as far northwards as the Central Provinces, and being quite unknown on the Malabar coast. Its fossil remains have been obtained from a cavern in Madras, thus proving that it was an inhabitant of India at a time when the fauna of that part of the country had a much closer affinity to the fauna of Africa than exists at the present day. The late Dr. Jerdon, in his *Mammals of India*, observes that "this very pretty little cat frequents grass on the dry beds of tanks, brushwood, and occasionally drains in the open country and near villages, and is said not to be a denizen of the jungles. I had a kitten brought to me very young in 1846, and it became quite tame, and was the admiration of all who saw it. Its activity was quite marvellous, and it was very playful and elegant in its motions. When it was about eight months old, I introduced it into a room where there was a small fawn of the gazelle, and the little creature flew at it the moment it saw it, seized it by the nape, and was with difficulty taken off. I lost it shortly after this. It would occasionally find its way to the rafters of bungalows and hunt for squirrels. Sir W. Elliot notices that he has seen several undoubted hybrids between this and the domestic cat, and I have also observed the same."

In commenting upon this account, Mr. Blanford observes that the alleged absence of the species from jungles is probably incorrect, for it has been found inhabiting forests in Ceylon. A pair of kittens of this species were at one time in the possession of Mr. R. A. Sterndale, and proved quite as tame, active, and graceful as the one mentioned above. After the death of one of the pair from snake-bite, the kitten of a domestic cat was obtained as a playfellow for the survivor, when the difference in the agility of the two creatures was very markedly exhibited.

THE FLAT-HEADED CAT (*Felis planiceps*).

The flat-headed cat is the second uniformly-coloured species, in addition to the lion, among the Old World cats. It is about the size of a domestic cat, but with a

relatively longer body, shorter legs, and shorter tail; the length of the latter being not more than from one-quarter to one-third that of the head and body. The fur is long and soft; and on the upper-parts it is of a dark rich reddish-brown colour, having a curious speckled silvery appearance, due to some of the hairs having white tips. In many specimens, at least, a pair of yellow lines diverge from above the nose on to the forehead between the eyes. The under-parts are whitish, more or less splashed with brown. The length of the head and body varies from 21 to 24 inches, while that of the tail is not more than from 6 to 8 inches.

The skull of this cat resembles that of the preceding species in having the sockets of the eyes surrounded by bone; but differs in having three premolar teeth in the upper jaw, the first of which is relatively larger than in any other living cat. The flat-headed cat has been obtained from the Malay Peninsula and the islands of Sumatra and Borneo; but nothing appears to have been hitherto ascertained as to its habits in the wild state.

Another uniformly-coloured cat, with fur of a bright chestnut tint, has been described from Borneo, under the name of the Bornean bay cat (*F. badia*). The tail is relatively longer than in the flat-headed cat.

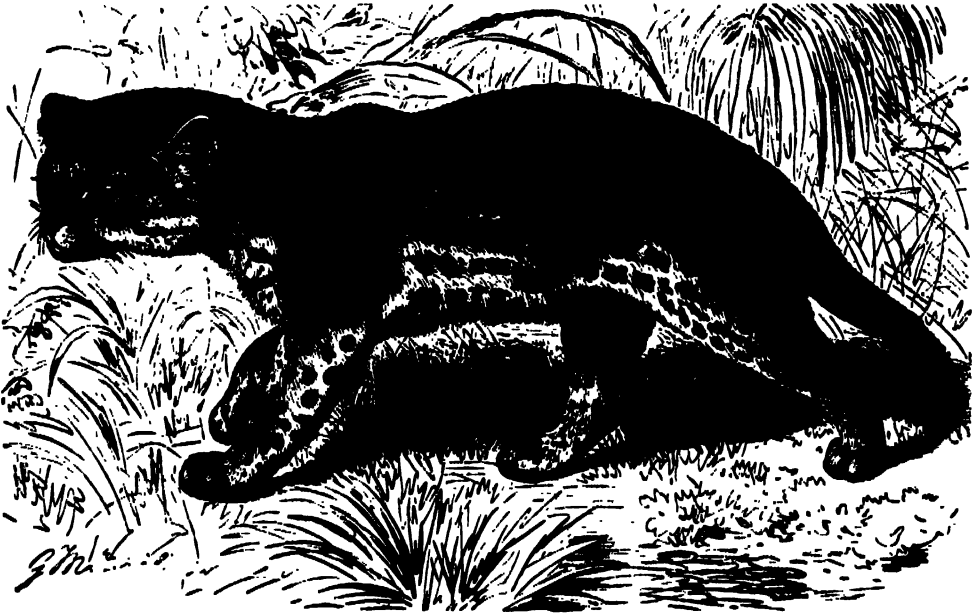
THE OCELOT (*Felis pardalis*).

If not equal in beauty of coloration to its much larger cousin the jaguar, the smaller South American cat known as the ocelot occupies at least the next place in this respect; and exhibits individual variations fully as marked as those occurring in the Asiatic leopard-cat. The ocelot is essentially a South American species, ranging northwards, however, into Mexico, and just impinging on the extreme south-western borders of the United States. Southwards it extends to Paraguay; but, according to Mr. W. H. Hudson, it is unknown on the pampas of Argentina, from which it may be inferred that its alleged occurrence in Patagonia is, at least, open to doubt. Like the leopard-cat, the ocelot, on account of its numerous variations in colour, has received a number of distinct scientific names. Prof. Mivart, describes the more general type in the following words:—"The ground-colour of the ocelot may be tawny-yellow or reddish-grey. It is always marked with black spots, which are aggregated in chain-like streaks and blotches, generally forming elongated spots, each with a black border, enclosing an area which is rather darker than is the general ground-colour. The head and limbs bear small spots, and there are two black stripes over each cheek, and one or two black transverse black bands within each fore-leg. The tail tends to be ringed, and the ventral parts of the trunk and limbs are whitish."

There is, however, a well-marked variety of a grey colour, in which the flanks may be whitish; while there is a second form characterised by its less brilliant coloration, the wider interval between the blotches, and the lighter colour of the areas enclosed by the black lines. Still more strikingly different is the third form, characterised by the fulness and intensity of its coloration, the ground-colour being bright fulvous, and the black markings exceedingly numerous and deep, while the white parts stand out in strong contrast to the rest. The pupil of the eye, when contracted, forms an exceedingly narrow vertical slit. Not only does

the ocelot vary in coloration, but it also displays considerable individual difference in point of size. Thus the total length of the animal may vary from 4 feet to 3 feet 1 inch, and that of the tail from 15 to 11 inches.

The ocelot appears to be an exclusively forest animal, and is said to be an expert climber, capturing most of its prey, which consists of small mammals and birds, in the trees. In disposition it is described as fierce and savage in the wild state. Jardine gives an account of a young specimen in captivity, which was



THE OCELOT ($\frac{1}{2}$ nat. size).

excessively playful, and fond of climbing, especially on the visitors, and was fairly tractable, although its docility depended to some extent upon the nature of its food.

THE MARGAY (*Felis tigrina*).

The margay is another American forest-dwelling species, which likewise exhibits considerable variation in colour and size; its range extending from Mexico to Paraguay.

The ordinary variety, according to Professor Mivart, "has rather harsh fur, of a dull grizzled colour, varied with black spots and rings. The tail is marked with small black spots, often confluent, but not forming rings. There are three transverse black stripes on the cheek. The head and body measure together a little over 24 inches, and the tail is about 11 inches long." There are, however, two well-marked varieties, one of which is known as the chati, while the other, represented in our figure on the next page, has been called *F. macrura*; both of these being characterised by the softness of their fur, their bright fulvous colour,

and the circumstance that their spots, which vary much in size, do not run together so as to form the chain-like pattern of the typical form. In some cases the black patches enclose central areas of a paler tint. In these varieties the length of the head and body may be but little short of 27 inches: while the length of the tail varies from 14 to 19 inches.

Another spotted cat, exclusively confined to South America, is Geoffroy's cat (*F. guigna*). It has generally been regarded as confined to the forest regions of Chili and Peru, but, according to Mr. W. H. Hudson, is also found on the Argentine



THE MANGAY († nat. s.)

pampas, where it is known as the wood-cat. Like the jaguar, it is, as Mr. Hudson remarks, probably there as an intruder from wooded districts to the northward of the pampas.

THE JAGUARONDI (*Felis*

The jaguarondi, inhabiting Brazil, Guiana, Paraguay, and North-East Mexico, but not extending to the northward of the Rio Grande, differs from all the American species yet noticed, with the exception of the puma, by its uniform coloration. In form it is characterised by its long body, short limbs, and the great length of the tail, which is nearly as long as the head and body. Its general colour is blackish or brownish-grey, but as in so many variable species there is a tendency to the special development either of an unusually greyish or an unusually rufous tinge. The total length of the cat is about 4 feet 7 inches, of which 2 feet 1 inch are occupied by the tail. The pupil of the eye is stated to be round: and the species is especially characterised by the peculiar manner in which the nose is, so to speak, pinched in from side to side.

THE EYRA (*Felis eyra*).

Strangest in form of all the cats is the South American eyra, which, from its long body, short legs, low withers, high rump, and extremely long tail, might almost be mistaken for a member of the weasel family, were it not for its relatively shorter face. In size it is almost equal to a rather small domestic cat, but with proportionately shorter legs. The fur is soft and of a uniform coloration, varying in tint from reddish-yellow to a brilliant chestnut, with the exception of a distinct whitish spot on each side of the upper lip. The pupil is round, and the skull still more elongated and depressed than in the jaguarondi, to which it is evidently closely allied, although the nose is not so much pinched in at the sides as in that species.



THE EYRA (A NAT.)

The range of the eyra is practically coextensive with that of the jaguarondi. And both species are described as being equally bloodthirsty in disposition, playing sad havoc with the fowls of the inhabitants of the districts which they frequent. The eyra, as might have been expected from its weasel-like shape, is, however, the more lithe and active of the two.

THE COLOCOLLO (*Felis colocollo*).

Almost the last of the true American cats that will be noticed here is the imperfectly known and rare colocollo, easily distinguished from all the other members of the family by its remarkable coloration. The colocollo is, perhaps, rather larger than an average domestic cat; and is of a greyish-white ground colour, ornamented with dashes of black on the back and sides, and further distinguished by a black streak running from the eye to the jaw. The tail is described as being imperfectly ringed with dark bands, while the lower limbs are

The caffre cat has a wide distribution, being found throughout Africa, from the Cape to Algiers and Egypt, and also extending into South-Western Asia in Syria and Arabia. In past times it also ranged into South-Eastern Europe: its fossilised remains having been obtained from the caverns of the rock of Gibraltar, in company with those of several extinct species of mammals. At the period when the caffre cat lived in Gibraltar, Spain was doubtless connected by land with Africa. These cats, as is well-known, were held sacred by the ancient Egyptians, and enormous numbers of their bodies were embalmed and preserved in tombs and pits; the largest repositories being found in the cities of Bubastis and Beni-Hassan. The cats found in the tombs of the two localities mentioned are regarded by Professor Virchow, who has devoted much study and attention to this subject, merely as tamed individuals of the wild caffre cat, and having no sort of relationship with the domestic cat; the origin of which, it is considered, is to be sought in Europe or Asia. On the other hand, Dr. A. Nehring,² of Berlin, whose opinion is entitled to much weight, considers that the black sole of the hind-foot, common to the caffre cat and the domestic cat of Europe, is indicative of the descent of the latter from the former, although it is quite probable that there may be also a strain of Asiatic blood in our cats. And much the same opinion is entertained by Professor Mivart. In this connection it is important to notice that in South Africa it has been ascertained that the domestic cat will breed freely with the caffre cat. On the other hand, as we have already had occasion to mention, there are several species of Asiatic cats, such as the leopard-cat and the rusty-spotted cat, together with others referred to below, which will cross equally readily with the domestic cat of India. It is, however, quite possible that this may not affect the origin of the European cat, since Dr. Nehring is of opinion that the domestic cat of the Chinese has an exclusively Asiatic descent, and is thus quite distinct from that of Europe; while Mr. Blanford suggests an Indian origin for the domestic cats of that country.

¹ Also known as *F. caligata* and *F. maniculata*.

² This writer considers that there are two species of Egyptian cat, viz., *F. caffra* (or *maniculata*), and *F. caligata*.

Darwin considered that the origin of the domestic cat could not be determined with certainty: and concluded by remarking that whether domestic cats have descended from several distinct species, or have only been modified by occasional crosses, their fertility, so far as is known, is unimpaired.

That the ancient Egyptians had succeeded in taming thoroughly the cats of which the mummified bodies are found in such numbers at Bubastis and Beni-Hassan, is perfectly well ascertained. This is indeed demonstrated by a painting in the British Museum, representing a fowling scene. Commenting upon this picture, Mr. P. H. Gosse observes that it appears to have been the custom for the fowler to enter upon such expeditions accompanied by some of the female members



THE CAFFRE CAT ($\frac{1}{2}$ nat. size).

of his family. "Embarking on board a boat, with a few decoy-birds and a trained cat, they proceeded to such parts of the river as were fringed with dense masses of the tall papyrus-reed. Waterfowl of various species swarmed in these rushy covers: and, by the number of nests with eggs and young usually represented, we are doubtless to infer that the possession of this sort of stock was no less desired than that of the birds themselves. The cat, strange as it appears, was certainly taught to seize upon the birds: in the picture before us she has just caught one in her mouth, while she holds another with her two fore-paws, and a third between her hind-paws. It is probable also that the repugnance of this animal to wet her feet having been overcome by training, she was accustomed to fetch such birds as fell into the water." In a footnote Mr. Gosse adds that it is "interesting to find the cat domesticated at so early a period. In the ochreous tints of the brindled fur, the two dark spots near the extremity of the tail, and a trace of the curved line upon the cheek, we think we recognise the *F. maniculata* [= *F. caffra*], to which modern naturalists have referred our domestic cat; though the Egyptian figure

disagrees with Rüppel's in its more robust form and stouter legs." Professor Mivart speaks of the cat represented in the same painting as a "tabby cat," and would appear to regard it as belonging to a domesticated species or variety. The evidence of the mummified cats, which are indistinguishable from the wild cat, points, however, strongly to the correctness of Professor Virchow's conclusion that the ordinary tamed cat of the ancient Egyptians belonged to that species. Still, however, it is quite probable that certain variations from the original type may in some instances have been produced by breeding in a domesticated state.

THE WILD CAT (*Felis catus*).

The wild cat is the only native representative of the family found within the British Islands, where it is almost daily becoming scarcer.

In general colour this species is not unlike many of our domestic "tabbies," from which it is distinguished, not only by its superior size and strength, but also by its stouter head, and the much shorter and thicker tail, which, instead of tapering, preserves a nearly uniform thickness to the tip. The ground-colour of the body is yellow-grey; the markings taking the form of a dark streak along the middle of the back, from which descend more or less nearly vertical stripes of the same hue, these stripes becoming nearly horizontal on the limbs, while the tail is ornamented with similar dark rings, and terminates in a black tip. The "whiskers" are more voluminous than in domestic cats; and in the male sex the soles of all the feet are black. The length of the tail is rather less than one-half that of the head and body. The male is considerably larger than the female, but shows a great amount of individual variation in its dimensions. According to the authors of Bell's *British Quadrupeds* the total average length of the males is about 2 feet 9 inches, of which 11 inches is taken up by the tail; but an unusually large specimen killed near Cawdor Castle had a length of 3 feet 9 inches from the nose to the tip of the tail.

The wild cat was formerly distributed over the forest-clad districts of the larger part of Great Britain, but, as we shall show later on, was never known in Ireland. It is widely distributed, in suitable localities over the Continent, occurring in France rarely, Germany commonly, Switzerland, Poland, Hungary, Southern Russia, Spain, Dalmatia, Greece, and parts of Turkey; but it is unknown in Italy, Norway, Sweden, and Northern Russia. The specimens from the more northern parts of its range are said to be larger, with longer and thicker fur, than those from its southern habitats. Eastwards it has been recorded from the shores of the Caspian; and a large cat with a short tail killed by the late Sir O. B. St. John in Persia was referred by its captor to this species. The skin was, however, unfortunately lost, so that the determination cannot be regarded as absolutely certain.

The wild cat has been an inhabitant of Great Britain since the age of the mammoth; its fossil remains having been obtained (both there and on the Continent) in caverns containing the bones and teeth of the mammoth and other extinct Mammals of the Pleistocene age. It has, however, now completely disappeared from the greater part of England, only remaining in the mountainous districts of



the north, its extermination from many of its former haunts being probably due not so much to the destruction of the forests, as to the increasing use of fire-arms. In parts of North Wales it appears to still linger on, a specimen having been captured recently in that district, but there is considerable doubt as to whether it continues to breed in the principality. In Scotland, although its distribution is now greatly restricted, the wild cat is not very uncommon in the more secluded localities.

Domestic cats that have escaped and taken to the woods are frequently mistaken for the wild cat; and it is owing to such errors in identification that, according to Dr. E. Hamilton, the supposed occurrence of the species in Ireland has been asserted.

Wild cats are expert climbers; and their favourite places of resort are the most inaccessible mountainous woods, where they retreat not only to hollow trees, or deep thickets, but to concealed fissures of rocks, in which they seek their safety and repose, and bring forth and rear their young. The female usually produces from four to five kittens in a litter; and instances are on record where these have been brought forth in the deserted or captured nests of some of the larger birds.

The fierceness and savage disposition of the wild cat, or "cat-a-mountain," as it was often called by the older writers, is proverbial, and displays itself even in the kittens, which will hiss and spit vigorously at all intruders on their lair. Several instances are related where wild cats have even attacked human beings. The destruction which they inflict on grouse, ptarmigan, rabbits, hares, fawns, and lambs, renders them detested alike by gamekeepers and shepherds, and has thus largely contributed to their reduced numbers in those parts of Britain where the species still survives. From the shortness and bushiness of its tail, there is good reason to believe that the wild cat is not the parent stock of our domestic cats. Still, however, there are undoubted instances where crossing has taken place between the two, such interbreeding having been frequently authenticated. On this point Jardine observes that "in the north of Scotland there has been occasional crossing with our native species, and the result of these crosses has been kept in our houses. I have seen many cats closely resembling the wild cat, and one or two that could scarcely be distinguished from it." Commenting on this statement, Blyth remarks that "such cats are never seen in the southern parts of England; still, as compared with any Indian tame cat, the affinity of the ordinary British cat to *F. catus* is manifest, and is due, I suspect, to frequent intermixture at a time when the tame cat was first introduced into Britain, and continued rare, while the wild species was far more abundant than at present."

PALLAS'S CAT (*Felis manul*).

Apparently nearly allied to the European wild cat is a handsomely-coloured species from the Siberian steppes, the Mongolian deserts, and the highlands of Tibet, known as the manul cat, or Pallas's cat. It is about the size of the ordinary domestic cat, with very long, thick, and soft fur, and a thick bushy tail, of about half the length of the head and body. The head is remarkably broad, and the eyes are directed more forward than in any other species.

The general colour of this cat varies from a silvery-grey to a yellowish-buff, becoming darker on the back, the chest being dark brown, while the underparts are lighter. The loins are marked by a few widely-separated transverse stripes, while the club-like tail has six or seven dark rings. Occasionally also the limbs may be slightly banded, while the front of the head is spotted, and the cheeks are marked by the usual pair of transverse streaks. The peculiar silvery "wash" on the fur is due to the circumstance that the ends of the longer hairs on the back are white, with short black tips.

In the steppes of Asia this cat takes the place of the wild cat of Europe. In the time of Pallas, its describer, its range extended from the southern flanks of the Urals through the Kirghiz, Turki, and Mongolian steppes to South Siberia, and from the foot of the Altai to Lake Baikal. Now, however, Pallas's cat appears to be unknown in the Orenburg steppes. Its food is said to consist largely of the small Rodents, commonly known as picae, or tailless hares (*Lepus*). It is this cat which was regarded by Pallas as being the ancestral stock from which the domesticated Angora or Persian breed took origin, although the evidence in favour of this view is insufficient.

THE INDIAN DESERT-CAT (*Felis ornata*).

As implied by its name, the Indian desert-cat, like the species last mentioned, is an inhabitant of open regions, and in this respect differs widely from its spotted compatriot, the leopard-cat. The desert-cat is another of the numerous species agreeing approximately in size with average domestic cats, but it differs from the three preceding species in that the ornamentation of the fur takes the form of spots, which may have a tendency to arrange themselves in longitudinal lines along the body. Moreover, the tail, instead of being short and bushy, as in the two preceding species, is comparatively thin, tapering, and about equal in length to the head and body. The general ground-colour of the desert-cat is pale sandy, or "isabelline"; the spots on the body are small and rounded, while those on the neck and head are still smaller, elongated, and tend to form lines. The outer surfaces of the limbs have dark bars, and the upper surface of the base of the tail is similarly barred, while near the end the tail is ringed, and its tip is black. The soles of the feet are also black below. This little cat is confined to the desert and sandy regions of Western India, being especially common in the deserts to the east of the Indus, in Sind, Western Rajputana, and Hurriana, where, according to Mr. Blanford, it subsists largely on the gerbils which abound in such regions. The spotted sandy fur of this cat probably harmonises well in colour with the desert sands dotted here and there with darker pebbles.

In the deserts of Eastern Turkestan, in the neighbourhood of Yarkand and Kashgar, this cat is replaced by the nearly-allied Shaw's cat (*F. shawi*), distinguished by its rather larger size and shorter tail.

Nearly related to the desert-cat is the far less common waved cat (*F. torquata*) from Northern India, Kashmir, Nipal, etc. This species is distinguished by its more uniform coloration of ashy-grey, becoming more or less rufous in some specimens, and passing into buff on the lower parts. The head and back are

marked by indistinct longitudinal dark bands, and there are also numerous rows of incomplete vertical stripes, passing into spots on the sides of the body. The under-parts are plain-coloured, but the tail and feet are marked as in the desert-cat, the under surface of the latter being, however, brown instead of black.

The desert and waved cats have a particular interest in relation to the origin of the domestic cats of India, since it appears that the former interbreeds with domestic cats, many of which, in the regions inhabited by the desert-cat, are spotted in a nearly similar manner. In regard to the waved cat, Mr. Blanford remarks that "nothing especial is known of the habits, and it is far from improbable that specimens of the present form are merely descendants of tame cats that have run wild. The converse is, however, equally probable, that this is the aboriginal race from which Indian domestic cats, and possibly those from other countries, are derived: and the circumstance that skins from parts of India so distant from each other as Nipal, Rajputana, and Kashmir, are precisely similar, is in favour of the latter view."

DOMESTIC CATS.

In the course of our survey of the last few species it has been incidentally mentioned how that the domestic cats of various countries interbreed with, and more or less closely resemble in coloration, some of the species of wild cats inhabiting the same districts. It has also been mentioned that the ancient Egyptians were in the habit of taming and training the wild *caffre* cat of their own country, which has been regarded by many authorities as the ancestral stock from which were derived the domesticated cats of Europe.

Without committing ourselves definitely to any one view, we confess that we are inclined to follow those who consider the *caffre* cat as the original parent stock of the domesticated breeds of Europe, but that, as suggested by Mr. Blyth, there has probably been, at least in many districts, a large amount of subsequent crossing of the original domestic breed with the wild cat. We are further disposed to believe that the domesticated cats of India may have had a totally independent origin from those of Europe, and we would also incline to the view that either the desert-cat or the waved cat (if the latter be a truly wild species) may have been the original parent stock from which they were derived. The common occurrence of spotted domestic cats in India—such being comparatively rare in Europe—is, indeed, highly suggestive of an origin from one or more of the numerous spotted wild species now inhabiting that country, while the general prevalence of "tabbies" in Europe is in favour of their origin from the *caffre* cat, with more or less intercrossing with the wild cat. It is, of course, possible that the prevalence of spotted domestic cats in India may be solely due to the effects of crossing with their wild compatriots, but the former is certainly the most natural view. Without going into the question of the origin of the domestic cats of other regions, we think, then, that, on the whole, the evidence shows that all those of Europe and Asia have not been derived from one single parent stock.

Having said thus much as to the probable origin of domestic cats, we pass on to consider briefly some of the most important and well-marked of their breeds. Before doing so we may, however, quote with advantage a passage from the

writings of Professor Mivart, pointing out the services which the cat confers on the human race. "The domestic cat," observes this writer, "is an animal so common and familiar that its utility is sometimes apt to be lost sight of. To realise its usefulness we must imagine ourselves in a land where no such animal is known, but where the annoying creatures upon which it preys shall have multiplied with that rapidity natural to them. The familiar tale of Whittington may serve to illustrate what would be the effect of its introduction into such a land. It has been calculated that a single cat may devour twenty mice in one day; but this, of



THE DOMESTIC CAT ($\frac{1}{4}$ nat. size).

course, is by no means the limit of its powers of destruction. Its effect in putting to flight the creatures it pursues is, again, far in excess of its destructive energy. Were every cat in England simultaneously destroyed, the loss through the entailed increase of vermin would be enormous."

On account of these invaluable qualities the domestic cat has been introduced into almost every country in the world. There is, however, still some degree of uncertainty as to the period when domesticated cats were first known in Europe, although they were undoubtedly in existence there previously to the Christian era. The mammal used by the ancient Greeks for the purposes for which we employ the cat, and called by them *ailuros*, was long considered to be the same as the modern

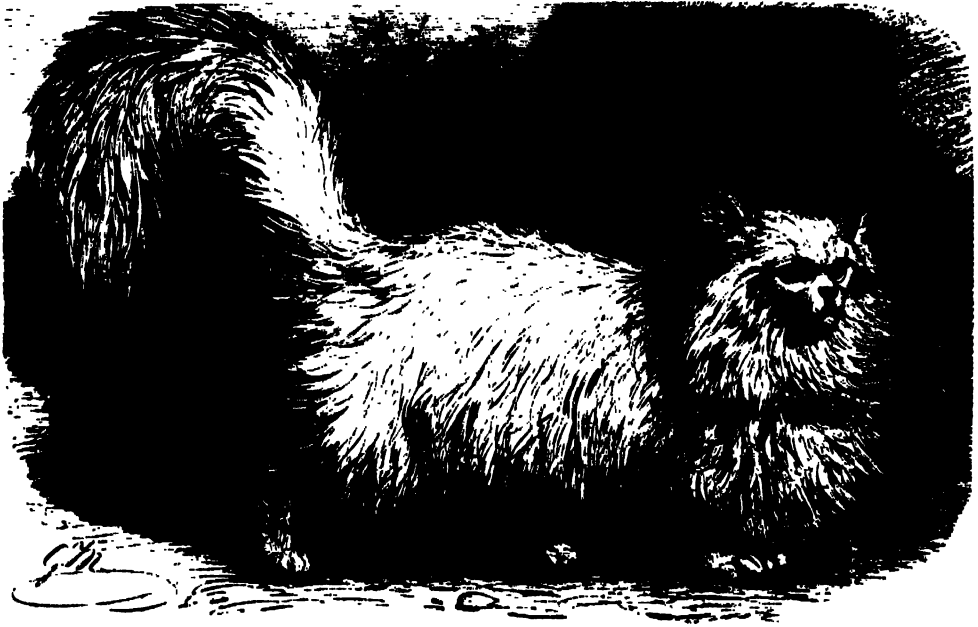
cat. The late Professor Rolleston, of Oxford, brought forward, however, a considerable amount of evidence to show that the *ailuros* of the Greeks was really a *marten*, and this view receives some support from the fact that no remains of cats have been discovered among the ashes of Pompeii and Herculaneum. That cats continued to be comparatively scarce and valuable animals during the middle ages, is proved by the laws made in several countries for their special protection, and the fines imposed on those who injured or killed them.

Coming now to the consideration of the various kinds of domestic cats, it may be observed, in the first place, that the different breeds of these animals are distinguished from one another mainly or entirely by such characters as colour, length of hair, or, more rarely, length of tail; and that they do not present the marked structural differences distinguishing the various breeds of dogs. This general similarity may be partly accounted for by the circumstance that all cats are required for much the same purpose, so that there has been no special inducement for breeders to modify the structure of the creature. A more important factor in the case is, however, in our opinion, the greater specialisation of a cat as compared with a dog, as is particularly shown in the shortness of the face, the diminution in the number of the teeth, and the peculiar structure of the cheek-teeth, it being sufficiently obvious that a short-faced and few-toothed animal is not capable of those modifications in the length and proportions of the skull, which can be so readily induced in creatures with longer muzzles and a greater number of teeth. That cats are, however, capable of perpetuating for a longer or shorter period structural modifications, is proved by a race of these animals with six toes on each foot, in which the peculiarity was inherited to the tenth generation.

As regards coloration, European cats are commonly either "tabby," black, white, sandy, tortoiseshell, dun, grey, or the so-called "blue"; the two latter colours being more rare than the others. All these different varieties will generally breed more or less nearly true if prevented from crossing, but it frequently happens that litters will contain different-coloured kittens. Formerly the ordinary European cats were short and smooth-haired animals, but of late years there has been a large amount of crossing with the Persian breed, which has resulted in the production of a number of long-haired cats. The true-bred "tabby" cat was, perhaps, the most common English variety, its well-marked vertical stripes being not improbably due to an original crossing with the wild cat. Its proper ground-colour is grey, marked with a black stripe down the back, and having subconcentric bands of the same colour on the sides and limbs. The rare grey cats may be regarded as tabbies which have lost all their stripes, with the exception of two transverse bars on the fore-legs. Black cats may probably be considered analogous to black leopards, since, even when purely bred, young kittens of this colour almost invariably show the stripes of the "tabby." Usually black cats have some white hairs, more especially on the throat, and, it is almost needless to remark, by an ever-increasing mixture of white, a perfect transition may exist from black to white cats, the same holding good with regard to the other breeds. In pure-bred black cats the eyes are of a clear yellow. In white cats, on the other hand, the eyes may be either of the ordinary greenish-yellow tinge, or of a pure blue, while in some cases one eye may be blue and the other yellow, this feature being especially admired in white Persian cats. As is

now well known, white cats with blue eyes are usually deaf, this deafness being probably attributable to the lack of dark pigment characterising the eyes also extending to the ears; such dark pigment being, in some mysterious manner, connected with the sense of hearing.

The pure-bred tortoiseshell cat—a race which, by the way, seems now much more rare in England than formerly—should be of an orange-fawn colour, irregularly blotched with black, without any admixture of white. Such cats are almost invariably females, although, according to Professor Mivart, there is at least one good instance of a pure “tortoiseshell tom.” The male of this breed is the sandy cat, and the writer above mentioned comments upon the extreme peculiarity in this difference of the coloration in the two sexes of this breed, the males and



THE ANGORA CAT ($\frac{1}{2}$ nat. size).

females of all wild cats, with the single exception of the South American jaguarondi (in which the female is the brighter of the two), being coloured alike. Occasionally, however, female sandy cats are to be met with, while sandy-and-white and tortoiseshell-and-white cats may be of either sex. The so-called “blue” or Carthusian cat is characterised by its long and silky hair being of a uniform greyish-blue colour, while the soles of the feet and the lips are black.

Turning to Asiatic cats, it has already been mentioned that many of those of India have more or less distinctly spotted coats like their wild compatriots, such coloration being almost unknown in Europe. The most celebrated of all the Asiatic breeds is the Persian, or Angora cat, its second title being derived from a town in Asia Minor. These cats are characterised by their large size, their long silky hair,—most developed on the throat and under-parts,—and the thick bushy tail. The colour is generally uniform, varying from pure white to a yellowish or greyish

tint, while the lips and soles of the feet are not uncommonly flesh-coloured. The occurrence of individuals with one blue and one yellow eye in this breed has been already mentioned, while allusion has likewise been made to the opinion that the Persian cat is descended from Pallas's cat of the Asiatic steppes. It was said some years ago that the breed of these cats in Angora had been greatly reduced in numbers, owing to their skins having been in large demand as furs.

In Siam there is a breed of cats reserved for royalty, characterised by their uniform, and often dark, fawn colour, their blue eyes, and the presence of two or more perfectly bald spots on the forehead. Siam, together with Burma, also possesses a breed known as the Malay cat, in which the tail is but of half the usual length, and is often, through deformity in its bones, tightly curled up into a knot. These short-tailed Asiatic cats lead to the mention of the tailless cats of the Isle of Man, in which the tail is either reduced to a mere stump, or almost wanting. Owing, however, probably to the introduction of ordinary cats from the mainland, cats in the Isle of Man are now to be met with having tails of all lengths up to 10 inches. Tailless cats, according to Professor Mivart, also exist in the Crimea, while they have been recorded by Kämpfer from Japan.

The other domestic breeds to which we shall refer include the Mombas cat from the eastern coast of Africa, said to be distinguished by its stiff and wiry hair, and the Paraguay cat of South America, which is much smaller than ordinary cats, with a long body, covered with close-lying short and scanty hair. The description of the latter is suggestive of some affinity with the cyra of the same regions.

Like many of the smaller wild species, the domestic cat has the pupil of the eye reduced to a narrow vertical slit when at its smallest dimensions. It also agrees with its wild cousins in the extremely small development of the sense of smell, depending chiefly upon sight and the exquisite sense of perception residing in the so-called "whiskers." The effects of domestication have, however, considerably increased the reproductive powers of the cat, the tame races having young three or four times during the year, and producing from five or six to eight or nine kittens at a birth.

With regard to its intelligence, Dr. Romanes observes that "the cat is unquestionably a highly intelligent animal, though, when contrasted with its great domestic rival the dog, its intelligence, from being cast in quite a different mould, is very frequently underrated. Comparatively unsocial in temperament, wanderingly predacious in habits, and lacking in the affectionate docility of the canine nature, this animal has never in any considerable degree been subject to the psychological transforming influences whereby a prolonged and intimate association with man has so profoundly modified the psychology of the dog. Nevertheless, the cat is not only by nature an animal remarkable for intelligence, but, in spite of its naturally imposed disadvantage of temperament, has not altogether escaped those privileges of nurture, which unnumbered centuries of domestication could scarcely fail to supply. Thus, as contrasted with most of the wild species of the genus when tamed from their youngest days, the domestic cat is conspicuously of less uncertain temper towards its masters—the uncertainty of temper displayed by nearly all the wild members of the feline tribe when tamed being, of course, an expression of the interference of individual with hereditary experience.

And, as contrasted with all the wild species of the genus when tamed, the domestic cat is conspicuous in alone manifesting any exalted development of affection towards the human kind: for in many individual cases such affection, under favouring circumstances, reaches a level fully comparable to that which it attains in the dog."

The writer then proceeds to observe that the most obvious trait in the "emotional" character of the cat is its strongly-rooted attachment to places as distinguished from persons, and it is considered that this is probably inherited from an instinctive attachment to their lairs, characteristic of its wild ancestors. The second feature in this aspect of the cat's nature is its partiality for torturing its helpless prey—a trait which Dr. Romanes ascribes to the delight of torturing for torture's sake.

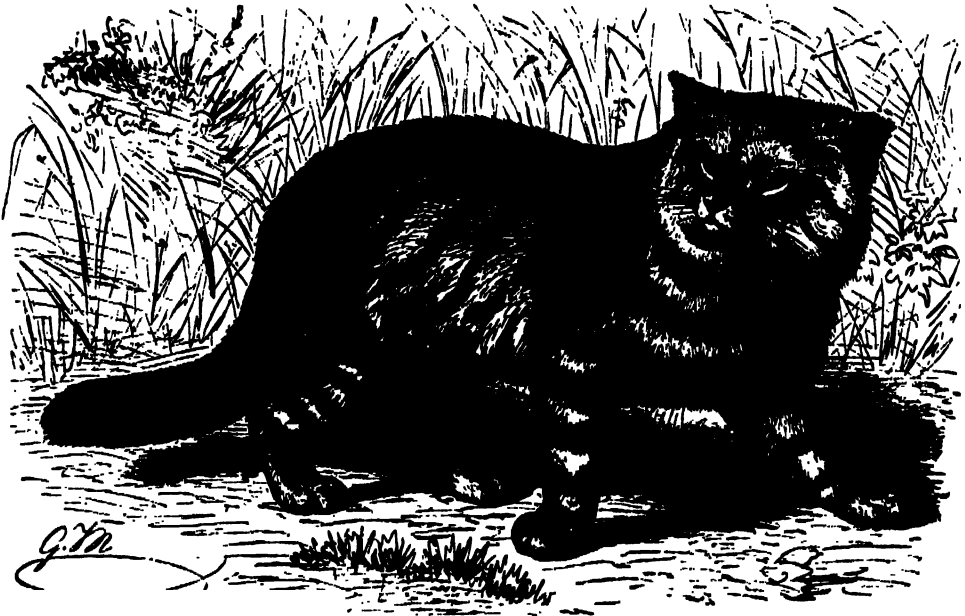
As regards their higher faculties, the same author observes that "it is to be noted as a general feature of interest that all cats, however domesticated they may be, when circumstances require it, and often even quite spontaneously, throw off with the utmost ease the whole mental clothing of their artificial experience, and return in naked simplicity to the natural habits of their ancestors. This readiness of cats to become feral is a strong expression of the shallow psychological influence which prolonged domestication has here exerted, in comparison with that which it has produced in the case of the dog. A pet terrier lost in the haunts of his ancestors is almost as pitiable an object as a babe in the wood: a pet cat under similar circumstances soon finds itself quite at home. The reason of this difference is, of course, that the psychology of the cat, never having lent itself to the practical uses of and intelligent dependency on man, has never, as in the case of the dog, been under the cumulative influence of human agency in becoming further and further bent away from its original and naturally imposed position of self-reliance, so that, when a severance takes place between a cat and its human protectors, the animal, inheriting unimpaired the transmitted intelligence of wild progenitors, knows very well how to take care of itself."

The terrible pests that domestic cats which indulge either in nocturnal poaching expeditions, or which have taken to a completely wild life in the woods, become, is known to all who have anything to do with rabbit-warrens or game-preserves. In the Island of St. Helena, Darwin tells us that a few cats which had been originally turned loose, in order to destroy the rats and mice, increased in numbers so as to become a perfect plague. And the same observer mentions that in some parts of South America the domestic cats which had run wild had become modified into larger creatures of exceeding fierceness, inhabiting rocky hills.

THE PAMPAS CAT (*Felis pajeros*).

With the pampas cat, also known as the straw-cat or the grass-cat, we come to the last of the South American cats, and also the only one absolutely confined to the barren regions of Argentina and Patagonia, ranging to the extreme southern limits of the latter country. From dwelling in such desert regions, the pampas cat may, as Professor Mivart remarks, well be regarded as the New World representative of Pallas's cat of the steppes of Central Asia.

This species is described as being of about the same size as the European wild cat, but of stouter build, with a smaller head and a still shorter tail. The fur is long and of a yellowish-grey ground-colour, marked with brownish or straw-coloured bands, running obliquely from the back across the flanks, the tail and legs being barred with similar bands. From the eyes two dark patches are continued downwards to meet on the throat. As usual, the under-part of the body is whitish. The total length of the animal is given as 3 feet 1 inch, of which 12 inches are occupied by the tail. The skull is remarkable for its extreme shortness, and likewise for the presence of only two premolar teeth in the upper jaw.



THE PAMPAS CAT ($\frac{1}{2}$ nat. size).

This cat may be regarded as one of the most distinctive animals of the pampas. Mr. W. H. Hudson speaks of it as not unlike *F. citus* in its robust form and dark colour, but a larger, more powerful animal, inexpressibly savage in disposition.

THE JUNGLE-CAT (*Felis* .

The common Indian jungle-cat is an important member of the family, since it serves to connect the more typical cats so closely with the lynxes as to render it impossible to refer the latter (as has been often proposed) to a distinct genus.

The jungle-cat is somewhat superior in size to the ordinary domestic cat, from which it differs in having a circular pupil to the eye, thereby agreeing with the lynxes. It also approximates to the latter in having a few long hairs on the tips of the ears, although these are not sufficiently numerous to form distinct tufts. The tail is, moreover, less elongated than in many of the true cats, varying from one-third to two-fifths the length of the head and body. In the presence of three

premolar teeth in the upper jaw, as well as in the form of the lower flesh-tooth, the jungle-cat agrees, however, with the more typical representatives of the family, as distinct from the lynxes.

The colour of the fur of the body varies from sandy or yellowish-grey to greyish-brown, the back being darker, with a tendency to reddish in some individuals or to a dusky tint in others, while the under-parts are whitish, with a yellow or red tinge. The individual hairs, which vary in length according to the locality whence the animals come, are not of uniform colour throughout their



THE JUNGLE-CAT ($\frac{1}{2}$ nat. size).

length, the upper ends being generally greyish-white, with black tips. Usually fully-adult animals are uniformly-coloured, but the limbs may be marked with dusky transverse bars, while, more rarely, rows of indistinct spots or wavy lines may be detected. The inner side of the upper part of the fore-limb usually has the two broad transverse bars common to so many cats. The cheeks and breast may be either banded or pale, while the tail is ringed, and its tip, like those of the ears, black. The soles of the feet are of a dusky-brown colour. The total length of the animal varies from 33 to 39 inches, the length of the tail (with the hair) in the smaller form being 11 inches.

Although the jungle-cat may be regarded as a characteristic animal of India, where it is found from Cape Comorin to elevations of about eight thousand feet in



CARACALS HUNTING.

the Himalaya, and also occurs in Ceylon and Burma, yet it has a wide range to the westward, being common in Persia, and thence extending through Syria to North Africa. Occasionally black specimens of this cat are met with in India.

The jungle-cat, although, from its nocturnal habits, rarely seen, is described by the late Dr. Jerdon as frequenting "alike jungles and the open country, and is very partial to long grass and reeds, sugar-cane fields, corn-fields, etc. It does much damage to game of all kinds,—hares, partridges, etc.,—and once I shot a pea-fowl at the edge of a sugar-cane field, when one of these cats sprang out, seized the pea-fowl, and, after a short struggle (for the bird was not dead), carried it off before my astonished eyes, and, in spite of my running up, made good his escape with his booty." It is said to be very destructive at times to poultry. The present writer once came suddenly upon the jungle-cat in the outer Himalaya on the edge of a recently-cut field of maize, which, after staring in astonishment for a few seconds, quietly made its way into cover.

In disposition the jungle-cat is described as being very savage; and, even when caught young, is generally untamable. It is said to breed twice a year (like the European wild cat), and to produce three or four kittens at a birth, which, when captured, are very difficult to rear. The late Sir O. B. St. John, as quoted by Mr. Blanford, when writing of his Persian experiences, states that among the mountains of the South he found three kittens of this species so young as to be unable to drink milk. "I reared them," continues this observer, "with some difficulty, till about three months old, by which time they became very tame and playful, climbing up on to my knees when at breakfast, and behaving very much like ordinary domestic kittens. Unfortunately one was killed by a greyhound, and another by a scorpion, within a few days, on which the survivor became morose, and refused to be comforted, even by the society of a kitten of his own age, which I procured as a companion to him. When I left Persia, in 1867, he was a year old, and very large and powerful. Two English bull-terriers I had, who made short work of the largest domestic cat, could do nothing with my wild cat. In their almost daily battles the dogs always got the worst of it."

THE CARACAL (*Felis caracal*).

The foxy-coloured cat known as the caracal is a species of larger size than the jungle-cat, though smaller than the true lynx, and agrees with the latter in its long limbs, pencilled ears, and the characters of its teeth; but in its longer tail, absence of a ruff round the throat, and less close and thick fur, it resembles the jungle-cat. The transition from the typical cats to the lynxes is, therefore, complete.

The caracal, in addition to its relatively long limbs, is characterised by its slender build, by the length of the tail being equal to one-third of that of the hind leg and body, and by the long tufts of black hair surmounting the long ears. From the latter feature the animal is known to the Persians by the name of *Siyah-gush*; *siyah* signifying black, and *gush* ears. The skull is characterised by the elevation of the crown, and the shortness of the face; while there are but two premolar teeth in the upper jaw, and the flesh-tooth of the lower jaw is distinguished by the

presence of the rudiment of the heel, which is found fully developed in that of the hyænas.

In colour the caracal varies from a uniform rufous fawn-colour to a brownish-rufous; the under-parts being either a paler rufous or white, and frequently marked with obscure rufous spots. The limbs and tail are coloured like the body, although in some individuals the tip of the tail may be black. The outer sides of the ears are either partially or completely black, while their interiors are white. The length of the head and body varies from 26 to 30 inches, and that of the tail from 9 to 10 inches; the height at the shoulder being from 16 to 18 inches.

This species is sometimes known as the Persian, and at others as the red lynx, but the latter name is properly applied to a North American variety of the true lynx. Although a rare animal everywhere, the caracal is spread over the greater part of India, with the exception of Bengal, the Malabar coast, and the Eastern Himalaya. It is unknown to the eastward of the Bay of Bengal, but towards the south-west it is found in Mesopotamia, and perhaps the Persian highlands. It is also found in Arabia; and over a large portion of Africa it is the sole representatives of the lynxes.

We have little or no information as to the habits of the caracal in Africa, and only a scant record of its mode of life in India. Mr. Blanford considers, however, that it probably dwells among grass and bushes, rather than in forests. Its prey is stated to consist largely of gazelles, the smaller species of deer, hares, pea-fowl, francolin, cranes, and other birds; and so active is the creature, that it is asserted to have the power of springing up and capturing birds on the wing at a height of five or six feet above the ground. The caracal is easily tamed, and in some parts of India is trained to capture several of the animals mentioned above as forming its natural prey. Blyth records that it is a favourite amusement among the natives to let loose a couple of tame caracals among a flock of pigeons feeding on the ground, when each of them will strike down as many as ten birds before the flock can escape. It is believed that the expression "lynx-eyed" owes its origin to this species.

THE LYNX (*Felis lynx*).

Few animals have given rise to more discussion among zoologists, in regard to the number of species into which they should be divided, than the true lynxes; some authorities regarding those found in North America as representing three species quite distinct from the typical Old World lynx, while others are disposed to consider the whole four as mere varieties of a single species. It was likewise at one time considered that there were two Old World lynxes occurring to the north of the Alps; one being the common lynx of Europe, and the other the Tibetan lynx. It has now, however, been shown that these two varieties pass imperceptibly into each other; but to the south of the Alps, the so-called pardine lynx is regarded as probably a distinct species. Without committing ourselves definitely to any one view, we shall treat of the whole of these various forms of lynxes, with the exception of the pardine lynx, under a single heading.

The true lynxes are mainly a northern group, being unknown in Africa,

India, and South America. They are very characteristic of North America, where, to the northwards of the Rio Grande, they are, with the exception of the puma, the sole representatives of the Cat family. Their range in the New World extends further to the southwards than in the Old World, as it there reaches to Southern California and the Rio Grande.

The whole of the true lynxes, whether we regard them as species or varieties, agree with the caracal in the form of the skull, the number and structure of the teeth, the black tufts to the ears, and the relatively long legs. They differ,



THE NORTHERN LYNX ($\frac{1}{4}$ nat. size).

however, by their stouter build, by the ruff of long hair fringing the throat, and the shorter tail, which is less than one-fourth the length of the head and body. They are further characterised by the softness and thickness of their beautiful fur, which is frequently marked with spots, and is highly valued by furriers.

Northern Lynx. Commencing with the true northern lynx of the Old World, we find that the colour of its fur varies from a pale sandy-grey, or isabelline tint, to a rufous-fawn washed with grey; some European skins being ferruginous red. The under-parts of the body are white. Although there is a great amount of local variation with regard to the presence of spots on the winter coat, it appears from the researches of Mr. Blanford that in the summer dress the fur of the

body is always marked with small black spots. In some instances, perhaps in animals only, these spots continue during the winter. This, however, appears to occur only among the lynxes of Europe; those of Asia having the winter dress without spots, except on the flanks and limbs, while they may be also wanting there. The hairs of the fur vary in colour in different parts of their length, and are tipped with black. The ears are grey on the outsides, with black margins, tips, and tufts. Occasionally the under-parts of the body are spotted. The length of a full-grown lynx, according to Mr. Blanford, is 33 inches exclusive of the tail, which measures only 7½ inches; but Professor Mivart says that the length of the head and body may be upwards of 40 inches.

The lynx now inhabits the northern districts of Sweden, Norway, and Russia; but appears to have been exterminated from the forest districts of Central Europe, where it was formerly common. A lynx was, however, killed in the Haute Loire, France, in the year 1822, and a second in Württemberg in 1846. Eastward the lynx extends through the greater part of Asia, north of the Himalaya, ranging through Tibet into Ladak, and occurring in the upper Indus valley as far westwards as Gilgit.

In Europe the lynx is a forest-dwelling animal, being an expert climber, and often found in trees. The lynx of Tibet, distinguished by Blyth as the isabelline lynx (*F. isabellinus*), is, however, an inhabitant of a barren country, and dwells in open ground among rocky districts. It is of a paler colour than the European variety, with shorter hair on the soles of its feet. This difference of coloration is, however, as pointed out by Mr. Blanford, doubtless due to the difference of its surroundings; this being confirmed in a remarkable manner by the lynx found in the Gilgit district, where a certain amount of forest occurs, which is intermediate in coloration between the European and Tibetan varieties. The Turkestan lynx resembles the one from Gilgit.

In Europe the lynx used to be found at low elevations, in Gilgit it occurs at elevations of about five thousand feet, while in Tibet it is not found below some fourteen to fifteen thousand feet in summer. The food of the lynx varies according to its habitat. In Europe it preys upon birds and upon mammals varying in size from mice to goats and sheep, and perhaps occasionally larger species. In disposition it is extremely savage, and will often kill more animals than it can devour; Dr. Scully mentioning that in Gilgit a pair of lynxes killed six sheep in a single night. From two to three cubs are produced at a birth; the lair being usually formed among rocks. The young are born blind.

When taken young, the lynx can be easily tamed. The writer saw a full-grown tame Tibetan lynx in the possession of the late Mr. W. H. Johnson, then governor of Ladak, in Leh, during the year 1874, and another in Calcutta in 1878, belonging to Dr. J. Anderson. Both specimens were very playful, although the former would occasionally be somewhat too free with its claws. It displayed marvellous agility in capturing the half-wild pigeons which abound in Leh.

In Ladak, where the lynx is a rare animal, but seldom seen by Europeans, its chief food appears to consist of the blue hares which occur in swarms in many of the higher valleys. General Kinloch writes that in the summer of 1866, when shooting at a high elevation near Hanle, in Spiti, "I suddenly came upon a female lynx with two cubs. I shot the mother, and as the cubs concealed themselves

among some rocks, I barricaded them in, and went on with my hunting. On arriving in camp, I sent back men to try and catch the cubs; in this they succeeded, and brought them back to me. They were about the size of half-grown cats, and more spiteful, vicious little devils cannot be imagined; they were, however, very handsome, with immense heads and paws. For two or three days they refused all food, but at the end of that time they fed quite ravenously from the



THE EUROPEAN LYNX ($\frac{1}{10}$ nat. size).

hand. They soon became very tame and playful, although always ready to set their backs up if at all teased, or if a dog came near them."

Canada Lynx.

Coming to the American species or varieties of lynxes, the first and largest is the Canada lynx (*F. canadensis*). Professor Mivart describes this as very like the European form, the specimens that came under his notice being smaller, and not exceeding 30 inches in length from the muzzle to the root of the tail, with a tail 5 inches long; but Mr. C. J. Nattrass says that the Canada lynx may exceed 3 feet in length. The same writer observes that in some

climates the colour of this lynx is almost white, although usually of a dark grey tinged with chestnut, with the limbs darker than the body. The back and the upper part of the legs are mottled with darker blotches, and the tips of the hairs are white.

The Canada lynx extends from Canada at least as far south as the Adirondack Mountains, near New York; and is the *loup cerrier* of the French Canadians. In the Adirondacks, where it is nowhere common, it preys, according to Dr. Hart Merriam, "upon the northern hare, and such other small mammals as it can catch, and upon the ruffed grouse and spruce partridge. It has also been known to devour pigs, lambs, and young fawns; but the accounts of its attacking full-grown deer are not to be credited. Its haunts are in the deep forests and bush districts, remote from the paths of man; and consequently it rarely intrudes upon the barn-yard. Its ordinary gait when in a hurry is a long gallop, like that of the hare, and it is said to swim well. The female commonly has two young at a birth, her lair being usually located in a cavern or hollow tree."

Mr. Nuttall states that this lynx when leaping over the ground, as it does in a series of successive bounds, with back arched, the tail so short as to be almost indiscernible, presents altogether a quaint, weird appearance, which has been described by many hunters and backwoodsmen as laughable and peculiar in the extreme. The same writer also relates an instance where a lynx, when hard pressed by dogs, took to the water and swam right across Lake Lemay, of which the width is almost a mile. He likewise states that the lynx will feast upon the forsaken prey of the puma, which may account for the legends of its killing the larger kinds of deer; smaller deer fall, however, frequent victims to the lynx. Mr. Nuttall records a cross-breed between the lynx and the domestic cat.

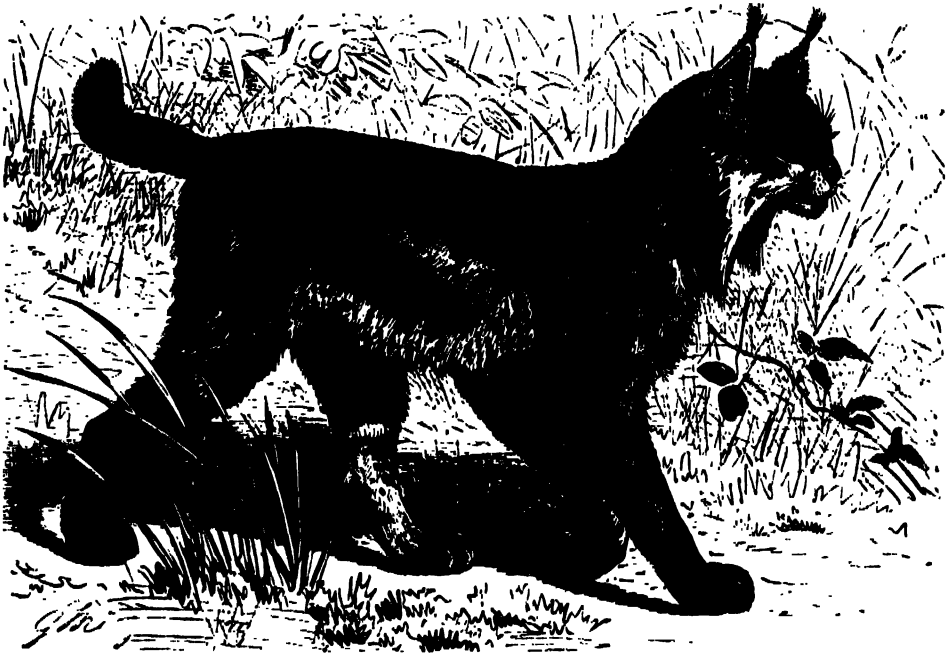
"The lynx," he says, "is seldom hunted systematically, as are the deer, elk, bear, and other game animals, unless it be by professional hunters or trappers, who value him for his pelt. With them the usual method is to hunt him with dogs trained to follow the trail by scent. In other cases his track is followed through the snow, by the eye, by a party of hunters, who, when starting out, must be prepared to make a long, hard tramp of many hours, or possibly several days. I have known a party, who wanted a lynx badly, to follow the trail of one all day, returning home as darkness set in. They returned to the hunt next morning, took up the trail where they left it the night before, and followed it all day, and again the next day, till they finally trailed the beast to its lair, treed, and shot it."

Bay Lynx.

The next form of the American lynxes is known indifferently as the bay lynx, red cat, or American wild cat, and is the *chat cerrier* of the French Canadians, and the *F. rufa* of those zoologists who regard it entitled to rank as a distinct species. In the typical form the fur is shorter and less abundant than that of the Canada lynx, and is of uniform reddish colour, while the tail appears to be more bushy. Its size is also somewhat inferior to that of the last-named kind. There is, however, a handsomer spotted variety of the bay lynx occurring in Texas and Southern California, which was formerly regarded as a distinct species (*F. maculata*); and a second from Washington and Oregon, distinguished by vertical dark streaks on the body, this variety having been named (*F. fasciata*).

Both these are, however, now generally regarded as mere geographical races of the bay lynx.

In the Adirondacks the bay lynx is very rare, probably on account of the climate being too severe for it, as it is far more common to the southward. "It frequents rocky hills and ledges," writes Dr. Merriam, "and does not show that antipathy to civilisation so marked in its congener the [Canadian] lynx. In fact, it is often quite common in thickly-settled portions of the State, and sometimes proves of much annoyance to the farmer by carrying off lambs, little pigs, and poultry,—ducks, geese, turkeys, and chickens proving equally acceptable. Away from the farmyard it feeds upon rabbits, squirrels, mice, grouse, and what small



THE PARDINÉ LYNX ($\frac{1}{2}$ nat. size.).

birds it is fortunate enough to capture. It generally makes its nest in a hollow tree or log, and lines it well with moss. From two to four young constitute a litter, the most frequent number being three." Dr. Merriam mentions the extremely spiteful disposition of the bay lynx, and adds, "I have eaten the flesh of the wild cat, and can pronounce it excellent. It is white, very tender, and suggests veal more than any other meat with which I am familiar."

The last of the American lynxes which the transatlantic naturalists now regard as a distinct species, is the plateau lynx (*F. baileyi*). This form takes its name from inhabiting the high plateau of Colorado, Utah, and Arizona: and is said to differ from the bay lynx in being uniformly paler above, and also by its shorter tail and softer fur. The back is suffused with a buff tint, and the blackish marblings found on the face and forehead of the bay lynx are wanting, while the black at the tip of the tail occupies a smaller area than in the latter. There is

THE PARDINE LYNX (*Felis pardina*).

The pardine or Southern European lynx is, perhaps, the handsomest representative of the entire group, its fur being distinctly spotted at all seasons of the year. The colour of the body is rufous above, and white beneath; the rounded black spots occurring on the body, tail, and limbs. From the examination of the skin alone, Professor Mivart says that he was disposed to regard this animal merely as a southern spotted variety of the common lynx, analogous to the spotted and banded southern varieties of the American bay lynx. An examination of the skull showed, however, such differences from that of the northern lynx as to lead to the conclusion that the pardine lynx was in all probability a distinct species.

This lynx is found in Europe in Spain, Sicily, Sardinia, Greece, and Turkey. Its habits are probably very similar to those of the northern species.

Fossil remains of the pardine lynx have been found in the caves of Gibraltar in company with those of the serval; and it thus becomes a curious subject for consideration why the former is now restricted to Europe, and the latter to Africa. Remains referred to the common lynx have been discovered in the caves of England and the Continent.

THE HUNTING-LEOPARD (*Cynalurus jubatus*).

The hunting-leopard (unless, as some writers think, there be two species) is the last representative of the Cat family, and differs so markedly in certain respects from all the others that it is now generally admitted to rank as a distinct genus. As already mentioned, it is generally known to Europeans as the chita (or cheetah); but since this name is at least equally applicable to the true leopard, its use is better avoided.

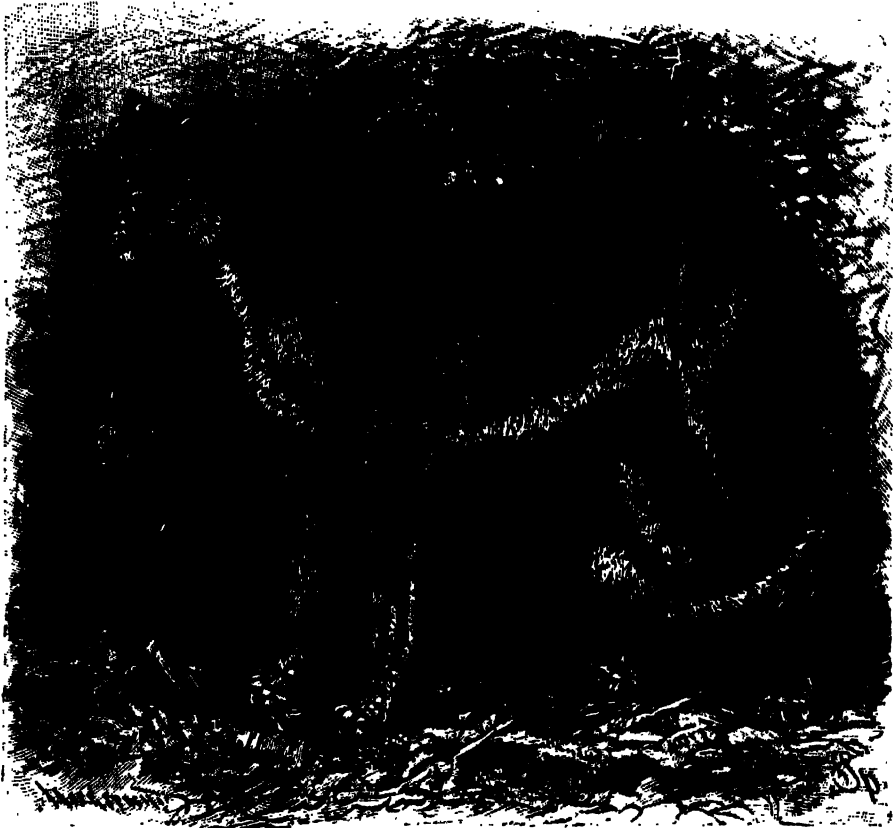
The points on which zoologists chiefly rely in making the hunting-leopard the representative of a separate genus are twofold. Firstly, and most important, the claws can only be partially withdrawn into their protecting sheaths, so that they always remain partly exposed. Secondly, the upper flesh-tooth consists simply of a trenchant blade, without the distinct lobe found on its inner side in the true cats and hyenas.¹ While, therefore, the hunting-leopard is a more generalised animal than the true cats in regard to its feet, the characters of its upper flesh-tooth indicate greater specialisation, this inner lobe occurring in all the more primitive types of Carnivores.

The hunting-leopard is distinguished by the slenderness of its body, and the great relative length of its limbs, which are longer than in any of the true cats, not even excepting the lynxes. In length of body it may be compared with the true leopard, although it stands much higher on the legs. The pupil of the eye is round, the ears are small and rounded, and the fur is rather coarse, and more or less lengthened on the neck and the under-parts of the body. The tail is relatively

¹ This lobe is shown in the figure of the upper flesh-tooth of a hyena on p. 353.

long, being equal to more than half the length of the head and body. The skull is characterised by the extreme elevation of the crown, as well as by the shortness of its facial portion; in both of which respects it resembles that of the snow-leopard. The first of the three upper premolar teeth is unusually small.

In colour the fur of the hunting-leopard varies from tawny to a bright rufous fawn tint, becoming paler on the under-parts. On this ground-colour black spots are distributed over almost the whole of the animal, with the exception of the



THE HUNTING LEOPARD ($\frac{1}{2}$ nat. size).

buff-coloured chin and throat: these spots being round, without any light-coloured centres, and not arranged either in rosettes or in lines. The head is marked by one black stripe running from the front corner of the eye to the upper lip, and sometimes by another from the hinder part of the eye to the ear. The ears are black on the outer surface, but tawny on the margins and at the base. On the tail the spots are confined to the upper surface, but towards the tip they tend to form incomplete rings. Such is the coloration of the adult of this animal. In the young cubs, however, the fur is very long—especially on the back—and of a uniform grey tint, without any trace of spots; but it is stated, that if a cub in

this state be clipped, the under-fur will exhibit distinct spotting. According to measurements given by Jerdon, an adult hunting-leopard has a total length of about 7 feet, of which $2\frac{1}{2}$ feet are occupied by the tail; the height at the shoulder varies from $2\frac{1}{2}$ to $2\frac{3}{4}$ feet.

This animal is one of the few members of the family common to all Africa and India; its range extending from Africa through Syria, Mesopotamia, and Persia. It is not found in Bengal, nor on the Malabar coast, nor to the northward of the Ganges. It is also said to be unknown in Ceylon; and, like all the cats common to Africa and India, with the exception of the leopard, does not occur to the east of the Bay of Bengal. Some years ago Mr. Selater described a hunting-leopard from South Africa which differed from the ordinary form by its stouter build, thicker tail, and more dense and woolly fur, the longest hairs occurring on the neck, ears, and tail. The spots were also much paler, and the lines between the eyes and the mouth absent. This "woolly hunting-leopard" was regarded by its describer as a distinct species (*C. lanius*), but several later writers have been indisposed to admit it to this rank.

We have but little information as to the distribution of the hunting-leopard in Africa. The Hon. W. H. Drummond states, on the authority of the natives, that in South-East Africa it is very rare, although found more commonly than elsewhere in the rocky gorges of the Bombo Mountains, where it lies concealed in the dense jungle, from which it occasionally ventures forth on to the open plains. Its chief prey consists of various species of antelopes. It is regarded as perfectly harmless, and indeed cowardly, towards man. Both Mr. Drummond and his native hunters appear to have often mistaken hunting-leopards for immature lionesses when seen at a little distance on the sandy plains. To the natives of South-East Africa the animal is known as the N'Gulule.

In India our information with regard to hunting-leopards is much fuller, owing to their being kept by many of the native princes for the purposes of sport, which entails the necessity of careful observation of their haunts and habits on the part of those entrusted with their training; and this more particularly as only full-grown examples are captured, the belief among the natives of India being that when captured as cubs they are of no use for sporting purposes.

According to Mr. Blandford, the principal haunt of the Indian hunting-leopard "is in low, isolated, rocky hills, near the plains on which live antelopes, its principal prey. It also kills gazelles, nilgai, and, doubtless, occasionally deer and other animals. Instances also occur of sheep and goats being carried off by it, but it rarely molests domestic animals, and has not been known to attack men. Its mode of capturing its prey is to stalk up to within a moderate distance of between one to two hundred yards, taking advantage of inequalities of the ground, bushes, or other cover, and then to make a rush. Its speed for a short distance is remarkable—far exceeding that of any other beast of prey, even of a greyhound or kangaroo-hound, for no dog can at first overtake an Indian antelope or a gazelle, either of which is quickly run down by *C. jubatus*, if the start does not exceed about two hundred yards. General M'Master saw a very fine hunting-leopard catch a black-buck that had about that start within four hundred yards. It is probable that for a short distance the hunting-leopard is the swiftest of all mammals."

It appears from the accounts of the natives who capture hunting-leopards that these animals hunt either in pairs or in family parties. After they have gorged themselves they repose in their lair for a couple of days or so, and then proceed to a particular tree, where they meet other members of their kind, whence they probably watch the movements of their expected prey. Such trees are recognised by the marks made on the bark by their claws, and the hunters are in the habit of capturing the leopards by surrounding the tree with a number of raw-hide nooses.

From time immemorial tame hunting-leopards have been kept by the native potentates of India, as part of the royal state, for the purpose of hunting the Indian black-buck (antelope) or other game. "In this sport," writes Sir Samuel Baker, "all persons, excepting the keepers of the animals, are simply spectators, and no interference is permitted. Each chita occupies a peculiar cage, which forms the body of a cart, drawn by two bullocks. When game is expected, the chita is taken from the cage, and occupies the outside seat upon the top, together with the keeper. The animal is blinded by a hood similar to that worn by a falcon, and it sits upright like a dog, with the master's arm around it, waiting to be released from the hood, which it fully understands is the signal that game is sighted."

On the particular occasion described, there were plenty of black-buck, and "we were not long," continues Sir Samuel Baker, "in finding a herd, in which were several good old buck, as black as night. Nothing could be more favourable than the character of the ground for the natural habits of the chita. The surface was quite flat and firm, being a succession of glades, more or less open, surrounded by scattered bush. A chita was now taken from its cage, and it at once leaped to the top, and sat with its master, who had released it from the hood. After an advance of about two hundred yards, the wheels making no noise upon the level surface, we espied the herd of about twenty antelopes, and the cart at once halted until they had slowly moved from view. Again the cart moved forward for seventy or eighty paces, and two bucks were seen trotting away to the left, as if they had caught a glimpse of the approaching cart. In an instant the chita was loosed. For a moment it hesitated, and then bounded forward, although the two bucks had disappeared. We now observed that the chita not only slackened its pace, but it crept cautiously forward, as though looking for the lost game. We followed quietly upon horseback, and in a few seconds we saw the two bucks about a hundred and twenty yards distant, standing with their attention fixed upon us. At the same instant the chita dashed forward with an extraordinary rush. The two bucks, at the sight of their dreaded enemy, bounded away at their usual speed, with the chita following, until all the animals were lost to view in the scattered bushes. We galloped forward in the direction they had taken, and in less than three hundred yards arrived at the spot where the chita had pinned the buck. This was lying upon its back without a struggle, while the firm jaws of its pursuer gripped it by the throat. The chita did not attempt to shake or tear the prey, but simply retained its hold, thus strangling the victim, which had ceased all resistance.

"The keeper now arranged the hood upon the chita's head, thus masking the eyes, which were gleaming with wild excitement, but it in no way relaxed its grip. Taking a strong cord, the keeper now passed it several times around the neck of the buck, while it was still held in the jaws of the chita, and, drawing the cord

tight, he carefully cut the throat close to the jaws of the tenacious animal. As the blood spurted from the wound it was caught in a large but shallow wooden bowl or ladle, furnished with a handle. When this was nearly full, the mask was taken off the chita, and, upon seeing the spoon full of blood it relaxed its grasp, and immediately began to lap the blood from the well-known ladle. When the meal was finished, the mask or hood was replaced, and the chita was once more confined within its cage, as it would not run again during that day."

Another account, written many years ago by the late Mr. G. T. Vigne, may be quoted, as somewhat amplifying the preceding one in certain points. The hunting-leopard, as soon as slipped from the cart, "walks towards the antelope with his tail straightened and slightly raised, the hackle on his shoulders erect, his head depressed, and his eyes intently fixed upon the poor animal, who does not yet perceive him. As the antelope moves he does the same, first trotting, then cantering after him: and when the prey starts off, the chita makes a rush, to which the speed of a racehorse is for the moment much inferior. The chitas that bound or spring upon their prey are not much esteemed, as they are too cunning: the good ones fairly run it down. When we consider that no English greyhound ever yet, I believe, fairly run down a doe antelope, which is faster than the buck, some idea may be formed of the stride and velocity of an animal who usually closes with her immediately, but, fortunately, cannot draw a second breath, and, consequently, unless he strike the antelope down at once, is obliged instantly to stop and give up the chase. He then walks about for three or four minutes in a towering passion, after which he again submits to be helped on the cart. He always singles out the biggest buck from the herd, and holds him by the throat until he is disabled, keeping one paw over the horns to prevent injury to himself. The doe he seizes in the same manner, but is careless of the position in which he holds her."

Many tame hunting-leopards become perfectly gentle and docile, rubbing themselves against the knees of visitors, and purring all the time like so many large cats. It should be observed that the tamed individuals of this species merely use their own natural instinct, and develop no new mental powers as the result of training.

EXTINCT CATS.

In the course of this chapter reference has been made to the occurrence of existing species of the Cat family in cavern and other superficial deposits. There are, however, in addition to these, a large number of fossil cats, differing more or less markedly from all existing species, and many of which belong to extinct genera: and no account of the family would be complete without some reference, brief though it must necessarily be, to these extinct types. Some of these as shown by the greater number of their teeth, and other characters, belong to what naturalists call more generalised types, and may have been the ancestral forms from which the living cats have originated: while others are more specialised than even any of the species living.

Referring first to what may be called true extinct cats, or those belonging to the genus *Felis*, we may mention that from strata belonging to the Pliocene or upper portion of the Tertiary period in the Siwalik Hills of India, there have been

obtained skulls of the great crested cat (*F. cristata*) which must have been fully as large as the tiger, but appears to show signs of affinity with the jaguar. Equally large cats (*F. atrox* and *F. augusta*) have left their remains in the strata of the same geological period in the United States. Numerous extinct cats of this genus also occur in the Pliocene deposits of France and other countries on the Continent of Europe, but these are of smaller dimensions, as also are those found in beds belonging to the upper half of the preceding Miocene period, below which true cats are unknown. The Siwalik Hills have also yielded the remains of a cat which is believed to indicate the existence of a species of hunting-leopard at the period when their rocks were in process of formation.

Passing on not only to extinct species but likewise to extinct genera, we may notice first those remarkable creatures known as sabre-toothed cats (*Machærodus*). These cats, some of which were equal in size to the lion and tiger, are all characterised by the enormous development of the tusks, or canine teeth of the upper jaw, which formed long sabre-like weapons projecting far below the lower jaw, as shown in our greatly reduced figure of the skull of one of the South American species. The great length of the upper tusks must have completely prevented them from biting in the ordinary manner, as, when the mouth was opened to its widest extent, these teeth would still have reached to the lower jaw. Hence the only mode in which they could have been used would appear to have been as striking or tearing weapons when the mouth was closed. In some species the cutting power of these teeth was increased by their sharp edges being finely notched like a saw.



SIDE VIEW OF THE SKULL OF THE SOUTH AMERICAN SABRE-TOOTHED CAT. (Greatly reduced.)

These sabre-toothed cats seem to have abounded in the Pleistocene and Pliocene epochs of the earth's history, their remains having been obtained from the cavern and other superficial deposits of England, the Continent, Persia, India, and North and South America. They are also known from strata of much older age, having been found in France in rocks belonging to the upper part of the Eocene period.

In the Miocene strata of the United States, and also in the Miocene and Upper Eocene rocks of Europe, there are found more generalised cats, many of which differ from existing forms in having three or four (instead of two) premolar teeth in the lower jaw; while some of them also have an extra molar tooth behind the lower flesh-tooth. In the presence of these additional teeth, they approach the other families of Carnivores: and this approximation is also shown by the structure of some of their teeth. Thus in many of them the upper flesh-tooth, instead of having three distinct lobes in the blade as in existing cats, has but two such lobes, as in a dog. In another form the claws, although still retractile, had not the bony sheaths of the modern cats. The animals to which these early cats seem to make the nearest approach are the civets, thus suggesting that the Cat family may have been derived from primitive Carnivores, more or less closely allied to the modern civets and their allies.

CHAPTER XIV.

CARNIVORES,—*continued.*

CIVETS, AARD-WOLF, AND HYÆNAS.

THE Carnivores described in the present chapter are those which exhibit the nearest affinity to the cats; and they are arranged in three distinct families. The first of these families includes the civets and their allies, and is represented by a large number of species; the second contains only a single species, the African aard-wolf; while the third is formed by the hyænas, of which there are three species now living. The whole assemblage is strictly confined to the Old World—both at the present day, and mainly also in earlier epochs of the earth's history:¹ and all of the species are inhabitants of the warmer regions of that hemisphere, none of them ranging into the strictly northern countries.

These animals agree with the cats (and thereby differ from all other Carnivores) in certain characters connected with the skull, and also in regard to the anatomy of their soft parts. The most obvious feature in connection with the skull is to be found on the under-surface in the region of the internal portion of the ear. Here the so-called bulla, lying immediately behind the cavity for the articulation of the lower jaw, is always inflated into a bladder-like form; the internal cavity of this bladder-like chamber being, except in the hyænas, divided into two compartments by a vertical partition of bone.

THE CIVET TRIBE.

Family *VIVERRIDÆ*.

Under the general title of civets may be included not only the animals to which that term is properly applicable, but likewise a number of more or less closely-allied Carnivores, such as genets, ichneumons or mungoses, palm-civets, linsangs, etc. This assemblage includes a much more diversified group than that represented by the Cat family, and is, therefore, much less easy of definition; the difficulty being considerably increased by one very aberrant species from Madagascar which connects the more typical members of the family very closely with the cats.

The whole of these animals have, however, more elongated faces than the cats, and their bodies are also longer, and their legs shorter than in the members of that family, not even excepting the peculiar *eyra*. They have a larger number of

¹ An extinct Carnivore recently described from North America has been referred to the hyænas.

cheek-teeth than any of the existing cats, the premolar teeth being never less than three—and very frequently four—on each side of both the upper and lower jaws. Moreover, with the single exception of the above-mentioned species from Madagascar (which is at once distinguished from all the cats by the presence of four premolar teeth), the civets always have two molar teeth in the lower jaw—that is to say, there is a tooth behind the lower flesh-tooth. Further, in nearly all cases there are also two molar teeth in the upper jaw and behind the flesh-tooth; these molar teeth (as shown in the accompanying figure of the upper jaw of the Indian civet) being generally of large size, and thus very different from the single small upper molar of the cats. With the above-mentioned exception, the upper flesh-tooth has but two lobes to the blade; while the lower flesh-tooth has a large tubercular heel behind the cutting blade. As a general rule, their feet have four toes; but in some cases the first toe (thumb) may be wanting in



THE LEFT HALF OF THE UPPER JAW OF THE INDIAN CIVET.

To show the form and number of the teeth. The fourth tooth from the left of the figure is the tusk, or canine; and the third tooth from the right side the flesh-tooth, or last premolar; the latter being the molars. (From the

the fore-feet, in others the corresponding toe may be absent in the hind-feet, while in others, again, both fore and hind-feet may be four-toed. Then, again, while in some forms the claws can be withdrawn into sheaths as completely as in the cats, in others they are but partially retractile; this difference depending, as pointed out by Mr. Blanford, to a great extent as to whether the animals walk on their toes (digitigrade), or on the soles of their feet (plantigrade).

None of the civets attain large dimensions; and they are chiefly characteristic of Africa, Madagascar, and South-Eastern Asia, only two species entering the southern parts of Europe.

THE FOSSA.

Genus *Cryptoprocta*.

The fossa of Madagascar, which is the largest Carnivore found in that island, is the species already alluded to as connecting the more typical members of the present family with the cats. This peculiar animal differs, indeed, so remarkably from all the other representatives of the civet tribe, that it has been considered by some that it ought to be referred to a separate family; but in most features it agrees so essentially with the civets that this view is now generally discarded by zoologists.

The fossa (*Cryptoprocta ferox*) is a nearly uniformly-coloured animal, with short and thick pale brown fur; and it attains a total length of about 5 feet from the snout to the tip of the tail, the length of the tail being more than three-quarters that of the head and body. The curved claws are sharp and retractile; and the

feet, each of which is furnished with five claws, are very similar to those of a cat, except that the whole sole of the hind pair is naked, and applied to the ground in walking. The fossa has a total of thirty-six teeth, of which the hinder ones, both in form and number, closely resemble those of the cats. Thus the flesh-tooth in each jaw is cat-like, while there is but a single small molar tooth behind the flesh-tooth in the upper jaw, and none in the lower jaw, the number of molars being therefore $\frac{1}{2}$. Unlike the cats the fossa has four premolar teeth on each side of both jaws, and thereby resembles the typical civets, although the first of these teeth is



THE FOSSA ($\frac{1}{2}$ nat. size).

generally shed at an early age. It is a purely nocturnal creature, of a fierce disposition, but scarcely anything is yet known of its habits. It was exhibited in the London Zoological Gardens for the first time in 1891.

THE TRUE CIVETS.

Genus *Viverra*.

The true civets, or typical representatives of the family, are at once distinguished from the fossa by the number and form of their cheek-teeth; the total number of the teeth is forty, of which on each side of both the upper and lower jaws three are incisors, one a canine, four premolars, and three molars. The flesh-teeth, of which the characters have been already briefly mentioned, are like those of the dogs, and thus different from those of the cats: the upper flesh-tooth having but two lobes to the blade (see figure on p. 449), while the lower flesh-tooth has a large heel behind its cutting blade (as seen in the figure of the skull of a fox given on p. 352).

The civets are further characterised by their long and flattened bodies; narrow and elongated heads; short limbs; small and rounded feet, each furnished with five toes, of which the claws are partially retractile; and the hairy soles of the feet (exclusive of the pads). With the exception of one species, the back has a crest of long hairs, which can be erected at will; the neck is marked by a black gorget; and the tail, which is of considerable length, is variegated by alternate dark and light rings. The whole of the fur is long and rough-looking, and thus presents a marked contrast to the sleek pelage of most of the cats. The civets all walk on the very tips of their toes. In addition to the above, all these animals are characterised by the great development of certain glands situated in the abdomen which secrete the well-known perfume which gives the name to the group. There are altogether



THE CIVET ($\frac{1}{2}$ nat size).

six species of true civets, of which five are Asiatic while one is African; one of the Asiatic species being smaller than all the others, from which it also differs by the absence of the crest of erectile hairs on the back. From this and other structural differences, this small civet is frequently referred to a distinct genus. Like the majority of the family, the true civets are nocturnal, and to a great extent solitary animals; and apparently some of them cannot climb. They are commonly known as civet-cats.

African Civet. The African civet (*Viverra civetta*), which is one of the larger members of the genus, inhabits the tropical portions of Africa; and is of a brownish-grey ground colour, marked with interrupted dark streaks, or blotches, over the whole body. The tail is dark-coloured, with the rings very indistinct in the terminal portion. Little is recorded of its habits in the wild state; but these are probably similar to those of the next species. This civet, together with other species belonging to the same genus, and likewise some of other genera, is kept in

cages for the purpose of obtaining its secretion, which is, however, now much less used in Europe than formerly.

Indian Civet. This civet (*V. zibetha*), of which the upper teeth are figured on p. 449, is an animal of nearly the same size as its African cousin, its total length being 50 inches, of which 18 are occupied by the tail. It is distinguished by having the erectile crest on the back, of a deep black colour; thus forming a distinct black stripe running from the shoulders to the first ring on the tail, which is bordered on either side by a pale band. There are several dark bands on the chest, shoulders, and thighs: but the sides of the body are either plain-coloured or with very indistinct markings; the general colour of the fur being a



THE INDIAN CIVET ($\frac{1}{2}$ nat. siz

dark grey, frequently with a more or less decided yellowish or brownish tinge. The tail is marked with six black rings, which are much wider than the intervening white ones: its tip being black. The Indian civet inhabits the eastern side of India, from Bengal to Sikkim, ascending in the last-named district to a considerable elevation in the Himalaya, and it is also found in Burma, the Malay Peninsula, Siam, and Southern China. Mr. Blanford states that this civet is generally a solitary animal; and that "it hides in woods, bushes, or thick grass during the day, wandering into open country and often coming about houses at night. Not unfrequently it is found in holes, but whether these are dug by it is doubtful. It is said to be very destructive, killing any birds or small mammals it can capture, and often attacking fowls, ducks, etc., but also feeding on snakes, frogs, insects, eggs, and on fruits and some roots." Civets take readily to water. The female produces during May or June three or four young at a birth, which are probably

born with their eyes open. Hounds and other dogs, when they come across the trail of a civet, are said to leave that of any other animal they may be pursuing.

The Malabar civet (*V. civettina*), which replaces the preceding on the Malabar coast, is a closely allied species, distinguished by the large transverse markings on the sides of the body.

Burmese Civet. The fourth, or Burmese civet (*V. megaspila*), may be recognised by the black line of the back being continued down the upper surface of the tail, in which the dark rings are continuous below, and at first not wider than the light interspaces. The sides of the body are marked with rather large and usually distinct spots, which may tend to coalesce into bands; and the terminal portion of the tail is black for a greater or lesser extent. This species seems to attain larger dimensions than the Indian civet, Mr. Blanford giving the total length of one example as 54½ inches, of which the tail occupied 17½ inches. It inhabits Burma, the Malay Peninsula, Cochin China, and the Island of Sumatra.

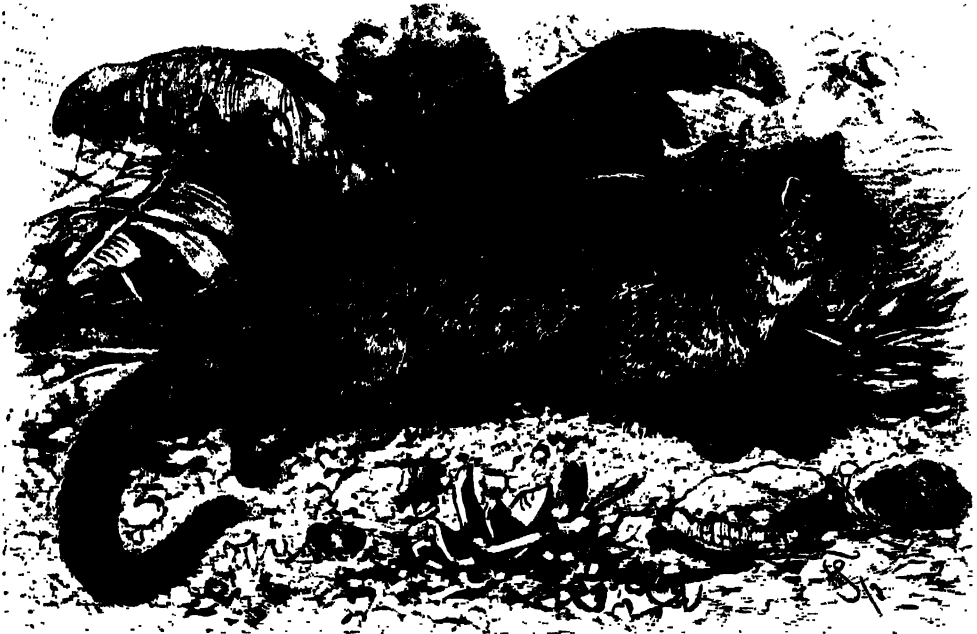
Javan Civet. The last of the five more typical species is the Javan civet (*V. tangalunga*), which is closely allied to the last, but distinguished by its smaller size, and the incompleteness of the dark rings on the under-side of the tail. This species has been recorded from Java, Sumatra, Borneo, and the Philippines. According to Mr. Wallace it also occurs in the islands of the Molucca group, where, however, it may very probably have been introduced by the Malays, who are in the habit of carrying civets about in cages to the various islands, where they are bought for their secretion. Dr. Guillemand relates, on the authority of a Dutch informant, that in Java a so-called "wild cat," which is very probably this species, has the curious habit of eating ripe coffee-berries, for the sake of their fleshy external covering.

Rasse. The last of the true civets is the rasse (*V. malaccensis*), the smallest member of the group, and distinguished, as already mentioned, from the others by the absence of erectile hairs along the middle of the back. As shown in our figure on the next page, it is a more slightly built and sharp-nosed animal than the others, with more curved and slender claws. The ground-colour of the fur is some shade of brownish-grey or yellowish-brown; upon which there are usually longitudinal dark lines down the back, and also rows of spots along the sides of the body. The dark rings on the tail vary from seven to nine in number. In size the rasse varies from 36 to 40 inches in total length: from 15 to 17 inches of this being taken up by the tail. This small civet is found over the greater part of India, although not occurring in Sind and the Punjab, and some of the adjacent portions of Rajputana. It is also found in Ceylon, and extends eastward from India through Assam to Burma and the Malay Peninsula, and thence to Southern China, Java, and some other islands. It has been introduced into Socotra, Madagascar, and the Comoro Islands. The rasse is said to differ from the other true civets in being a good climber and arboreal in its habits. It is, however, found in bush-covered districts rather than in thick forest: dwelling either in holes in the ground or among rocks. In confinement it is easily tamed, and feeds on such small animals as it can catch.

The comparatively large number of true civets inhabiting India and Malaysia, as contrasted with the single representative of the genus found in Africa, suggests that in the later periods of the earth's history the Oriental region was the original

home of the group. This is confirmed by what we know of their past history, for the remains of an extinct species have been found in a cavern in Madras, and those of two others in the Pliocene rocks of the Siwalik Hills in the north of India; one of the species from the latter district being far larger than any existing civet.

At a still earlier period—in the Lower Miocene and Upper Eocene—civets were, inhabitants of Western Europe, their remains having been discovered both in England and on the Continent. We have thus another instance of the derivation of the modern mammalian fauna of the East from the old European fauna, to which we have already had occasion to allude. The old civets of Europe differ somewhat in the characters of their teeth from the living species, but appear in



THE RASSE ($\frac{1}{2}$ nat. size).

other respects to have been nearly allied. Very few of the existing genera of mammals date so far back as the upper portion of the Eocene period, and civets may be regarded as one of the oldest groups in the class.

Omitting mention of an animal from Madagascar closely allied to the rasse, and known scientifically as the *Fossa*—which must not be confounded with the *fossa* mentioned above—our next representatives of the family are

THE GENETS.

Genus *Genetta*.

Among the little animals known as genets is one of the two members of the civet family found in Europe. Although nearly related to the true

civets, the genets may be distinguished by the greater proportionate length and slenderness of their bodies, and their shorter legs, as well as by their longer and more tapering tails, and their shorter and blunter claws. Then, again, the hind-foot of a genet will be found to differ from that of a true civet by having a narrow naked surface extending for a long distance in the under-surface behind the pads. Another point of difference is to be found in the absence in the genets of a pouch for containing the secretion; a character in which they agree with the fossa described on p. 449. All these animals have short and soft fur, of which the ground-colour is brownish-yellow or greyish. Down the middle of the back runs



THE GENET ($\frac{1}{2}$ nat. size).

a black line, while the sides of the body are marked with black or brown spots; and there are also characteristic dark and light markings on the head and face. The black rings on the tail, which are variable in number, are generally narrower than the intervening white spaces.

As the true civets are mainly Oriental in their distribution, having only one species beyond the limits of that region, so the genets are chiefly African. The common genet (*Genetta vulgaris*), which occurs in the northern part of Africa, is, indeed, the only species found beyond that continent, its range extending into Spain, the south of France, and South-Eastern Asia. In 1890 a single specimen was recorded from the department of Eure, in the north of France. It is definitely known from Asia in Syria, but may also occur in South-East Persia. Of the four

exclusively African species, the blotched genet (*G. tigrina*) ranges from the Cape to Abyssinia, the feline genet (*G. felina*) is South African, while the remaining species (*G. senegalensis* and *G. pardina*) are from the west coast. Genets are easily tamed; and in the south of Europe the common species is often kept in houses for the purpose of killing rats and mice.

THE LINSANGS.

Genera *Linsang* and *Poiana*.

The most beautifully coloured of the civet-like animals are the linsangs, of which there are three nearly allied Oriental species, and a fourth from Africa. All the linsangs—the name would seem to be of Malayan derivation—are characterised by their very long and slender bodies, the shortness of their limbs, the elongation of the head and neck, and the extreme length of the tail, which may exceed that of the head and body together. The claws can be completely withdrawn within their sheaths; the whole of the soles of the feet are generally hairy; and there is no scent-pouch. The fur is characterised by its shortness and softness, and is very thick, so that the skin is almost like velvet pile. The ground-colour of the fur is some shade of fulvous, marked with bold black spots or patches: the long tail being ringed with black. On account of their striking and handsome coloration, the name of tiger-civets has been suggested for these animals. An examination of the skull will show that instead of the forty teeth found in the true civets and genets, they have only thirty-eight; this diminution being due to the loss of the second upper molar, so that there is but one tooth behind the flesh-tooth of the upper jaw instead of the two shown in the figure on p. 449.

They are all carnivorous, but it is suggested that some of them may also feed on insects. The Asiatic linsangs are characterised by the large size of their spots, which frequently form squarish patches, tending to form transverse bands. These species constitute the genus *Linsang*.¹ The one African linsang, on the other hand, has smaller spots, which have no tendency to run into bands over the greater part of the body. It has also a naked line running up the sole of the hind-foot, as in the genets. From these slight differences this animal has been made the type of a separate genus—*Poiana*.

The earliest known of these animals was the Javan linsang (*Linsang gracilis*), from Java, Borneo, and perhaps Sumatra, shown as the upper figure of our coloured Plate. It is the smallest of the linsangs, with a coloration similar to that of the next species, but with a different kind of skull.

The Burmese linsang (*L. maculosus*), which is the largest, and perhaps the handsomest, of the group, appears to be a rare animal, and is at present known only by two specimens, one obtained from near Moulmein, and the other in South Tenasserim. It is represented in the lower figure of the Plate. The tail is slightly shorter than the head and body; the length of the two latter being about 19 inches, and that of the former (including the hair at the tip) just under 17

¹ The name *Prionodon* is generally used in this sense, but it clashes with a nearly similar name applied to an armadillo.



LINSANGS.

inches. The body has a greyish ground-colour, marked with about six very broad and somewhat irregular brownish-black transverse bands extending across the back, and separated by very narrow intervals. On the flanks and neck the markings form broken longitudinal lines and spots, one very distinct line always extending from behind the ear to the shoulder. The outer surfaces of the fore-limbs and of the thighs are spotted; and the tail has seven complete dark rings, separated by narrower light interspaces; its tip, as in the genets, being lighter.

The spotted linsang (*L. pardicolor*), which is found from the South-Eastern Himalaya to Yunnan, is a somewhat smaller animal; the length of the head and body being only 15 inches. It is readily distinguished by its coloration; the back being marked with longitudinal rows of large oblong spots, instead of the transverse bands of the last species.

A tame specimen of this beautiful animal was once kept by Mr. Brian Hodgson in Nepal. He describes it as very docile, fond of notice, and never giving vent to any kind of sound. It was free from the strong odour characteristic of the true civets, and was fed upon raw meat. Mr. Hodgson states that in its wild condition this species is equally at home on trees and on the ground; and that it dwells and breeds in the hollows of decayed trees. It is not gregarious at all, and preys chiefly upon small birds, upon which it is wont to pounce from the cover of the grass. The times of breeding are said to be February and August, and the litter to consist of two young, there being two litters each year.

The African linsang (*Prionailurus papuensis*), of which some of the distinctive characters have been already mentioned, is found only on the West Coast, in Sierra Leone and Fernando Po, and is, therefore, widely separated from its Oriental relatives. The tail is somewhat longer than the head and body, measuring upwards of 40½ inches; whereas the total length of the head and body is but 38 inches. The spots, as already mentioned, are smaller than in the Oriental linsangs, and, with the exception of some stripes on the back of the head, and a line extending from the neighbourhood of the ear to the shoulder, do not run together into lines or patches. The tail is peculiar in that the light rings separating the large dark bands are divided in the middle by very narrow dark rings.

THE PALM-CIVETS.

Genus *Paradoxurus*.

The palm-civets, tree-cats, or toddy-cats, as they are indifferently called, form an Asiatic group, with a single outlying West African species, of civet-like animals, differing in several important respects from all the preceding types, which are more or less closely allied. The number of the teeth is the same as in the true civets; but the individual teeth are usually much smaller in proportion to the size of the skull; and the flesh-teeth are by no means of such a markedly cutting type. There are also important distinctions in the structure of the skull. In most cases the tail is uniformly-coloured, or only ringed at its base. Moreover, all these animals are largely of arboreal habits.

The typical palm-civets, constituting the genus *Paradoxurus*, are exclusively Asiatic, ranging from India and Burma through the Malayan region to the south of China, and also occurring in the Philippines, Celebes, and Formosa. They may be either uniformly-coloured or striped, and, with one exception, have no rings on the tail, which is very long, but not prehensile. In size most of them may be compared to a large cat with relatively short legs. Their ears are small and rounded, the pupil of the eye is vertical, and the claws are completely retractile. The most distinctive external feature is to be found, however, in the soles of the feet, which, in both the fore and hind-limbs are almost completely naked; the bald



THE COMMON PALM-CIVET ($\frac{1}{2}$ nat. size).

area being continued backwards from the foot-pads without the intervention of any hairy space.

The palm-civets are purely nocturnal and thoroughly arboreal in their habits; their food, in accordance with the structure of their teeth, consisting in part of animal and in part of vegetable substances. The name *Paradoxurus*—often anglicised into *Paradoxure*—was given to these animals on account of a caged specimen in Paris having its tail coiled up in a peculiar manner. It was believed that this was the normal condition, and that the tail could be used as a prehensile organ. It appears, however, that although the palm-civets have naturally some power of coiling and uncoiling their tails, yet that the permanently coiled condition, as shown in the Paris and some other caged specimens, is a kind of disease due to the effects of captivity. Altogether there appear to be upwards of eleven well-

distinguished species of true palm-civets, five of which are found in India and Burma. In nine of these species the tail is considerably more than half the length of the head and body; and in eight of these it is uniformly-coloured. The Celebes palm-civet (*P. musschenbroeki*), forming the ninth in this series, is, however, distinguished by having its tail banded with indistinct rings of darker and lighter brown. The imperfectly-known woolly palm-civet (*P. laniger*) was described upon the evidence of a single skin, said to have been obtained from Tibet, and differs from all the rest in the woolly nature of its fur, and also by the length of the tail not exceeding that of the head and body. It is not certain that it really belongs to the same genus as the other species. The eleventh species is known only by a skull remarkable for the large size of its teeth.

The best known of all the species is the common Indian palm-civet (*P. niger*)¹, found throughout the greater part of India and Ceylon, and figured on p. 458. In this species the tail is nearly or quite as long as the head and body; and the general colour of the coarse and somewhat ragged fur a blackish or brownish-grey, without any stripes across the back in fully adult individuals. The length of the head and body of a male measured by Mr. Blanford was 22½ inches, and that of the tail 19½ inches; the corresponding dimensions of a female being in one instance 20 and 17½ inches, while in a second both were about 18 inches.

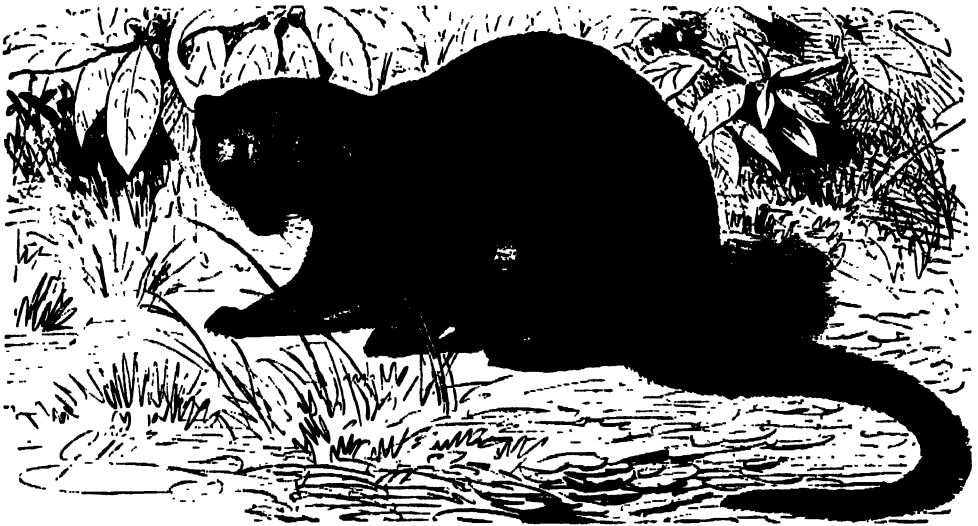
Writing of this species, the late Dr. Jerdon observes that "it lives much on trees, especially on the palmyra and coconut palm, and is often found to have taken up its residence in the thick thatched roofs of native houses. I found a large colony of them established in the rafters of my own house at Tellicherry. It is also occasionally found in dry drains, outhouses, and other places of shelter. It is quite nocturnal, issuing forth at dark, and living by preference on animal food, rats, lizards, small birds, poultry, and eggs; but it also freely partakes of vegetable food, fruit, and insects. In confinement it will also eat plantains, boiled rice, bread-and-milk, etc. Colonel Sykes mentions that it is very fond of cockroaches. Now and then it will commit depredations on some poultry-yard, and I have often known it taken in traps baited with a pigeon or a chicken. In the south of India it is very often tamed, and becomes quite domestic, and even affectionate in its manners. One I saw at Trichinopoly went about quite at large, and late every night used to work itself under the pillow of its owner, roll itself up into a ball, with its tail coiled round its body, and sleep till a late hour in the day. It hunted for rats, shrews, and lizards. Their activity in climbing is very great, and they used to ascend and descend my house at one of the corners in a most surprising manner." This palm-civet is common in Lower Bengal, and in the gardens of the suburban residences of Calcutta may occasionally be seen in the late afternoon or evening crawling among the leaves of a palm previous to starting on its nocturnal wanderings. That it will sometimes take up its quarters in the very heart of the town of Calcutta is proved by an incident which happened to the present writer when on the staff of the Geological Survey of India. At that time (1874) the office of the Survey was situated in a street leading down to the Hughli, in the old part of the city. On arriving at the office he found his papers on the writing-table marked every morning with the footprints of some mammal. He thereupon

¹ Also known as *P. musanga*.

procured a packing-case, which he converted into a 4-trap, and set, properly baited, one night in his room. Next morning he found that the box had fallen, with a tenant inside. The tube of a sulphuretted-hydrogen bottle was then inserted through a hole bored in the side of the box, and the latter, after an interval, lifted, when the dead body of a palm-civet was disclosed.

The name of toddy-cats is applied to these animals from the partiality they, in common with the fox-bats, display in Southern India and Ceylon for the palm-juice, or toddy, collected by the natives in vessels suspended on the trees. Like the other members of the group, the Indian palm-civet, when irritated, gives forth a most unpleasant odour.

The Malay palm-civet (*P. hermaphroditus*), which is represented in the accompanying illustration, occurs throughout the countries to the eastward of the



THE MALAY PALM-CIVET ($\frac{1}{4}$ NAT. SIZE.)

Bay of Bengal, as far as Siam, and is distinguished from its Indian congener by the presence of a pale-coloured band running across the forehead, and also by the general presence of stripes across the back in the adult condition. In both the preceding species the "whiskers" are black, but in the golden palm-civet (*P. aureus*) of Ceylon, and also the brown palm-civet (*P. jerdoni*) of Southern India, they are respectively rufous and dark brown; the body-colour of those two species being nearly the same as that of their whiskers. On the other hand, the Himalayan palm-civet (*P. grayi*), which occurs throughout Sikkim and Assam, is readily distinguished by its white whiskers; while it is further characterised by the great backward production of the bony palate of the skull. The golden palm-civet is said to be less carnivorous than the other species.

The Chinese palm-civet (*P. larvatus*), of which we give a figure on the next page, is closely allied to the Himalayan palm-civet, but differs by the browner tinge of its greyish fur, and by the markings on the head being very distinct, and black and white in colour. It has also a broad white band

running down the head and nose. It is rather smaller than the Himalayan palm-civet, although its exact dimensions are still unknown. In Southern China this palm-civet is found in Hangchow, and the provinces of Kwangtung and Fokien; and it likewise inhabits the Island of Formosa.



THE CHINESE PALM-CIVET ($\frac{1}{4}$ nat. size).

THE SMALL-TOOTHED PALM-CIVETS.

Genus *Arctogale*.

The two species of small-toothed palm-civets are distinguished (as their name implies), among other characters, from the members of the preceding genus by their relatively smaller cheek-teeth, and have hence been referred to a distinct genus, under the name of *Arctogale*. Externally these civets may be readily distinguished from the typical palm-civets by the soles of their feet being still more extensively naked, and likewise by the greater degree of divergence of the first toe of both pairs of feet from the other digits. The white-eared small-toothed palm-civet (*A. leucotis*) is an inhabitant of Assam, Burma, Tenasserim, the Malay Peninsula, Sumatra, and Java: while the second species (*A. trivirgata*) is restricted to the island last mentioned. The former is a short-furred animal, of a fulvous or dusky-grey colour, sometimes nearly brown on the back, and always paler below, with a tail about as long as the head and body. It is readily distinguished by the presence of three dark bands, which may be either continuous, or broken up into spots, running down the back of the otherwise uniformly-coloured body. In a male specimen the total length of the head and body was $26\frac{1}{2}$ inches, and that of the

tail 27 inches. When taken young it is said to be readily tamed. The small size of the cheek-teeth—especially the nearly triangular form of the upper flesh-tooth—suggests that it feeds largely upon vegetable substances. The second species is closely allied, having three similar dark stripes down the back.

THE HEMIGALES.

Genus *Hemigale*.

Another type of palm-civet is represented by the so-called Hemigale, for which there does not appear to be any recognised English title. Of this genus there are two species, the one, Hardwicke's hemigale (*H. hardwicki*), found both in the Malay Peninsula and Borneo, and the other, or Hose's hemigale (*H. hosei*), confined to Mount Dulit in the northern part of the latter island, where it has only recently been discovered. The hemigales are distinguished from the other palm-civets by having a much smaller portion of the soles of the feet naked, and likewise by their coloration, which is different from that of any other representatives of the family, although approached to some extent by the linsangs. This characteristic coloration takes the form, in the typical Hardwicke's hemigale, of a variable number of broad transverse dark bands crossing the back, of which the ground-colour is a pale brownish-grey; the number of these bands being very generally either five or six. There are also some dark longitudinal stripes on the nape of the neck; while the upper half of the tail is banded with dark rings. A peculiarity of these animals is that the direction of the hair on the back of the neck is reversed. Their habits are probably very similar to those of the other palm-civets.

THE AFRICAN PALM-CIVET.

Genus *Nand*

The last member of this group is the African palm-civet (*Nandinia binotata*), which although nearly allied to the Oriental forms is distinguished by certain structural peculiarities in the skull, and also by having a shorter muzzle than any other member of the family to which it belongs. The fur is of a greyish-brown colour, with the back and sides marked with large dark spots, and a pale spot on either side of the shoulders from which it takes its second scientific name. The tail, which is about two-thirds the length of the head and body, is indistinctly ringed with dark bands; the animal thus being the fourth representative of the palm-civets in which the tail is thus ornamented. In size this animal is rather smaller than the average of the typical palm-civets.

The African palm-civet is found on the West Coast, in the district of Fernando Po; and it will be thus apparent that it presents precisely the same relation to the Oriental palm-civets in respect to geographical distribution as is presented by the African linsang to its Eastern cousins. We are not acquainted with any account of the habits of this animal, but the nature of the teeth suggests that it lives largely on flesh.

THE BINTURONG.

Genus *Arctictis*.

The remarkable animal, represented in the accompanying illustration, and known as the binturong, or bear-cat, although nearly allied to the palm-civets, is yet so different from the members of that group in certain respects as to be entitled to notice under a special heading. It is the sole representative of its genus, and has a rather wide distribution in the Oriental region, ranging from

THE BINTURONG ($\frac{1}{2}$ nat. siz.).

Assam through Arakan, Tenasserim, Siam, the Malay Peninsula, Sumatra, and Java. The binturong (*Arctictis binturong*) is distinguished from all the other members of the civet family by the long tufts of hair surmounting the ears, and also by the prehensile nature of the long and somewhat bushy tail. As regards size, the length of the head and body varies from 28 to 33 inches, and that of the tail from 26 to 27 inches. The tail is thus nearly as long as the head and body, and it is characterised by its great thickness at the root, from which it tapers gradually; it is covered with bristly straggling hairs, which exceed in length those of the body. The whole of the fur is, however, long and coarse,—more especially on the back,—and is of a uniform black tint, more or less washed with grey on the head and fore-limbs, and occasionally all over the body.

The cheek-teeth of the binturong, although of the same general type, are even proportionately smaller than in the small-toothed palm-civets, with which they agree in number. The last molar tooth in the upper, and the first premolar in the lower jaw may, however, be wanting in some individuals. These peculiarities in the teeth, coupled with the other structural characteristics of the animal, lead to the conclusion that the binturong is a highly modified and specialised member of the palm-civet group, of which the nearest relatives are the small-toothed palm-civets. Writing of the habits of the binturong, Mr. Blanford observes that it "is omnivorous, living on small mammals, birds, fishes, earth-worms, insects, and fruits; it is also nocturnal and arboreal, its power of climbing about trees being much aided by its prehensile tail. It is rather slow in its movements. Its ability to suspend itself by its tail has been questioned, but Blyth has shown that the young, at all events, can support itself by the extremity of the tail alone. Blyth also remarks that it is the only known placental mammal with a truly prehensile tail in the Old World. This species inhabits wild forests, and, owing to its nocturnal and retiring habits, is seldom seen; it is said, however, to have a loud howl. It is naturally fierce, but when taken young is easily tamed, and becomes very gentle and playful. Of its breeding, nothing appears to be known." It has been stated that in the young state the binturong is spotted.

THE CYNOGALE.

Genus *Cynogale*.

As the palm-civets and the binturong represent the arboreal type of the family



THE CYNOGALE ($\frac{1}{2}$ nat. size).

under consideration, so the cynogale (for which there is no English name) presents us with a form adapted specially for a partially aquatic mode of life.

This animal (*Cynogale bennetti*) is another inhabitant of the eastern part of the Oriental region, where the civet tribe attains its greatest and most peculiar development, being found in the Malay Peninsula and the islands of Borneo and Sumatra. In appearance the cynogale somewhat resembles a small otter, the muzzle being very broad and furnished with thick bristles, while the body is shorter and stouter than in other members of the family, and the tail unusually short, its total length being only some 6 inches, while that of the head and body is upwards of 24 inches. The toes of the feet are webbed at their bases, and are further remarkable for their shortness. The teeth are the same in number as those of the palm-civets, but the premolars have unusually tall crowns, apparently adapted for holding and biting the fish, upon which it largely subsists.

According to Mr. Wallace, this animal is exceedingly rare in Borneo. Not only does it swim well and readily, but it is also said to be a ready climber. In addition to fish, crabs, etc., which form a considerable proportion of its diet, it is also reported to eat the flesh of such land animals as it can catch, and likewise various fruits.

THE MUNGOOSES.

(Genus *Herpestes*, etc.

Of late years the time-honoured name ichneumon, applied to the Egyptian representative of the group of civet-like animals, into the consideration of which we now enter, has been very generally rejected by zoological writers in favour of the term mongoose, the native Indian name for the Oriental species.

Using, then, the latter term, the mongooses form a well-defined group of small civet-like animals, with very long and generally uniformly-coloured bodies and tails, which differ in several important characteristics from the members of the family hitherto noticed. A large number of the mongooses are included in the typical genus *Herpestes*, of which the range includes not only the African, but also the Indian and Malayan regions; and of which one species is found in Spain. The other mongooses come from Africa, which may thus be regarded as the headquarters of the group.

The mongooses differ from the members of the civet family yet described by several important modifications in the structure of the skull, into the consideration of which it would be impossible to enter in the present work. It may be observed, however, that the socket of the eye (orbit) is very frequently surrounded by a complete bony ring, while in all the forms hitherto noticed it is widely open behind; and that the teeth are always relatively tall, with sharp cusps adapted for a thoroughly carnivorous diet. Mongooses may be distinguished at a glance by their long straight claws, which are incapable of retraction, and are, therefore, always protruded, like those of a dog; and no mongoose ever has scent-glands comparable to those so generally present among the true civets and palm-civets.

So important are these differences that zoologists now divide the civet tribe

into three primary groups, or subfamilies; the first of these being represented solely by the fossa of Madagascar, the second including the true civets, genets, palm-civets, etc., and the third the mungoses and their allies.

The true mungoses, or those constituting the genus *Herpestes*, are so well known as to be familiar to many of our readers. They have long, weasel-like bodies, and a more or less elongated tail, which is generally thick at the root, and may be covered with long hair; its general colour being like that of the body, but the tip often darker. The longer hairs of almost all the mungoses are marked with alternate darker and lighter rings, which communicate a peculiar and characteristic speckled appearance to the fur. The head has a pointed muzzle, with a rather short nose, in which there is a median groove on the completely naked under-surface. The ears are small and rounded. The limbs are likewise of extreme shortness, the feet being provided with five toes, of which the first, both in front and behind, is extremely small. These toes are generally detached, but may be slightly connected by a small web at their bases. The under-surfaces of the fore-feet are generally naked; while in most cases only the front part of the soles of the hind-feet are free from hair. It may be added that most mungoses have the same number of teeth as the true civets, that is forty: but, owing to the loss of a premolar on each side of the lower and upper jaws, in some species the number may be reduced to thirty-six.

As already mentioned, the true mungoses have a wide distribution, ranging over the greater part of Africa, extending across the Straits of Gibraltar into Spain, and eastwards through the south of Asia as far as the islands of the Malayan region. The number of species belonging to the typical genus is comparatively large, Africa claiming eight¹ (among which is the one ranging into Spain), and the same number being recognised by Mr. Blanford from India, Ceylon, and Burma. In respect of size the mungoses exhibit a considerable degree of variation, for, whereas the head and body of the smallest species may be compared to those of a weasel, the larger forms rival a domestic cat in dimensions. Summarising the habits of the mungoses, Mr. Blanford describes them as terrestrial Carnivores, seeking their prey on the ground, and very rarely climbing trees. They are active, bold, and predacious, and live on small mammals, birds and reptiles, insects and eggs, and occasionally eat fruit. They are deadly enemies to snakes, as described under *H. mungo*. They live in holes in the ground, hollow trees, and similar places. When angry or excited, they erect their long hairs, and especially those of their tails.

The typical representative of the genus is the Egyptian mungoose or ichneumon (*H. ichneumon*), inhabiting Africa, north of the Sahara Desert, Palestine, Asia Minor, and the southern portions of Spain. It was one of the sacred animals of the ancient Egyptians, and is often depicted on their frescoes. It is reported to feed largely upon the eggs of crocodiles, although this habit has not been recorded of any of the Indian species. It was, and we believe still is, domesticated in Egypt; and has the same antipathy to snakes alluded to under the head of the common Indian species. The Egyptian mungoose is a large species; the length of the head and body being about 20 inches, and that of the tail some

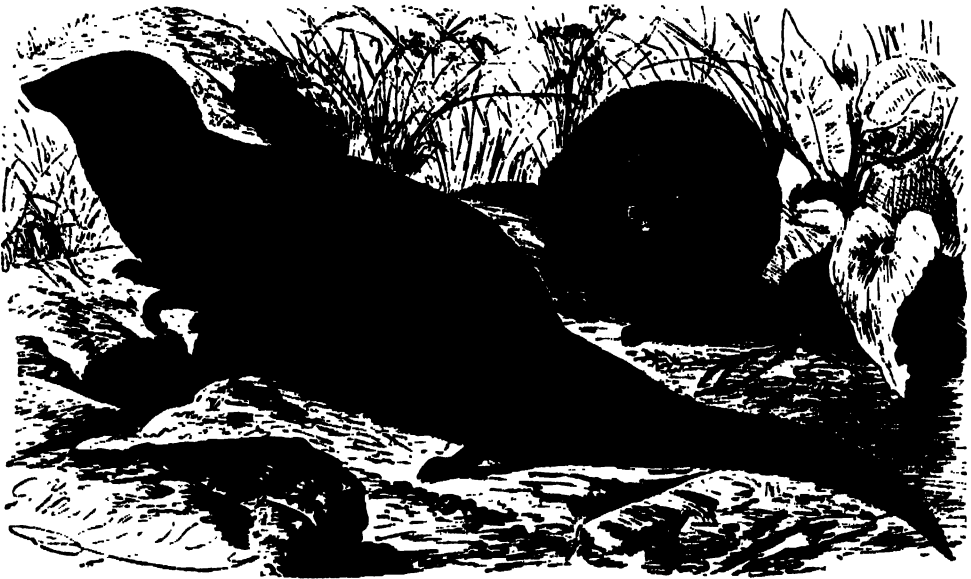
¹ There is also a species known only by the skull, which is believed to be African.



EGYPTIAN MUNGOONES.

15 or 16 inches. It is characterised by the tip of the tail being black, and the grizzled grey-brown colour of the fur, in which the individual hairs are ringed with reddish-brown and creamy-yellow. South of the Sahara this species is replaced by the slightly larger but closely allied caffre mungoose (*H. caffer*), in which the hairs are ringed with black and white. In South Africa, as far north as Zanzibar, we have also a much smaller species, the slender mungoose (*H. gracilis*), agreeing with the two preceding forms in the black tip to the tail, while in Kordofan the nearly equal-sized red-tailed mungoose (*H. sanguineus*) is distinguished by its general fawn-coloured fur, and the red tip to the tail.

Three other South and West African mungoses of large size are characterised by the tip of the tail being of the same tint as the body-colour. The largest and most distinct of the African species is, however, the white-tailed mungoose



THE INDIAN MUNGOOSE ($\frac{1}{2}$ nat. size).

(*H. albicauda*), in which the length of the head and body varies from 22 to as much as 26 inches. This species is distinguished from all the above by the under-surface of the ankle being hairy, instead of nearly or quite naked, and also by its bushy tail. The general colour is blackish-grey, the longer hairs being ringed with black and white, and having the tips black. According to Mr. Thomas, the white-tailed mungoose presents a remarkable individual variation in the colour of the fur of the tail. The hairs are of considerable length, "in some cases with white bases and long shining black tips, so that the whole tail appears to be black; in others with a long white tip beyond the black, so that then the tail appears to be white; in the latter case the hairs at the extreme tip of the tail being generally wholly white." This species ranges from the eastern part of Abyssinia to Natal, and reappears on the West Coast in the Guinea district.

Of the Oriental mungoses we select for especial notice the common Indian

mongoose (*H. mungo*), which belongs to a group of several species characterised by their uniform coloration, there being no stripe on the neck and no black tip to the tail. It is a comparatively large species, with rather long hair, of which the general colour is grey or rufous; the length of the head and body varying from 15 to 18 inches, and that of the tail from 14 to 15 inches. This species is found throughout peninsular India, from the Himalaya to Cape Comorin, and also occurs in Ceylon, although unknown in the countries to the eastward of the Bay of Bengal. The common Indian mongoose, writes Mr. Blanford, "is found in hedgerows, thickets, groves of trees, cultivated fields, banks of streams, and broken bushy ground, but not commonly in dense forests. It is often found about houses. It lives and breeds in holes dug by itself. Very little appears to be known of its breeding habits. It is often seen in pairs. The young are three or four in number, and are produced in the spring. The food of this animal is varied. It lives principally upon rats and mice, snakes and lizards, such birds as it can capture, eggs and insects; but it eats fruit at times. The stomach of one killed near Secunderabad contained, according to M'Master, a quail, a small wasp's nest, a lizard, a number of insects, and part of a custard-apple." In disposition this animal, for its size, is decidedly fierce and bloodthirsty. Jerdon says that "not unfrequently it gets access to tame pigeons, rabbits, or poultry, and commits great havoc, sucking the blood only of several. I have often seen it," he adds, "make a dash into a verandah where some cages of mynas, parakeets, etc., were daily placed, and endeavour to tear the birds from their cages."

In spite of its natural fierceness, the mongoose is easily tamed, and forms a gentle and affectionate pet. Tamed mongooses are largely carried about in India by snake-charmers and other wandering showmen. The following excellent account of a tame mongoose of this species (which ultimately died from grief at the absence of its master) is given by Mr. R. A. Sterndale:—"I got it," writes the narrator, "whilst on active service during the Indian Mutiny, when it was a wee thing, smaller than a rat. It travelled with me on horseback in an empty holster, or in a pocket, or up my sleeve: and afterwards, when my duties took me out into camp, 'Pips' was my constant companion. He knew perfectly well when I was going to shoot a bird for him. He would stand up on his hind-legs when he saw me present the gun, and run for the bird when it fell. He had, however, no notion of retrieving, but would scamper off with his prey to devour it at leisure. He was a most fearless little fellow, and once attacked a big greyhound, who beat a retreat. In a rage his body would swell to nearly twice its size, from the erection of the hair; yet I had him under such perfect subjection that I had only to hold up my finger to him when he was about to attack anything, and he would desist. I heard a great noise one day outside my room, and found 'Pips' attacking a fine male specimen I had of the great bustard (*Eupodotis edwardsi*), which he had just seized by the throat. I rescued the bird, but it died of its injuries. Through the carelessness of my servants, he was lost one day in a heavy brushwood jungle some miles from my camp, and I quite gave up all hope of recovering my pet. Next day, however, in tracking some antelope, we happened to cross the route taken by my servants, when we heard a familiar little yelp, and down from a tree we were under rushed 'Pips.' He went to England with me after that, and was the delight

of all the sailors on board ship, for his accomplishments were varied. . . . From watching him, I observed many little habits belonging to these animals. He was excessively clean, and, after eating, would pick his teeth with his claws in a most absurd manner. I do not know whether a mungoose in a wild state will eat carrion, but he would not touch anything tainted, and, though very fond of freshly-cooked game, would turn up his nose at 'high' partridge or grouse. He was very fond of eggs, and, holding them in his fore-paws, would crack a little hole at the small end, through which he would suck the contents. He was a very good rat-ter, and also killed many snakes against which I pitted him. His way seemed to be to tease the snake into darting at him, when, with inconceivable rapidity, he would pounce on the reptile's head. He seemed to know instinctively which were the poisonous ones, and acted with corresponding caution. I tried him once with some sea-snakes, which are poisonous, but he could get no fight out of them, and crunched their heads off, one after the other."

Much has been written as to the combats of both the Egyptian and the Indian mungoose with venomous snakes, and also as to the alleged immunity of these animals from snake-poison. On these points Mr. Blanford writes as follows:—"The prevalent belief throughout oriental countries is, that the mungoose, when bitten, seeks for an antidote, a herb or root known in India as *mungus-wail*. It is scarcely necessary to say that the story is destitute of foundation. There is, however, another view, supported by some evidence, that the mungoose is less susceptible to snake-poison than other animals. The mungoose is not always willing to attack, though at other times he is ready enough to fight. I have not seen many combats, but, so far as I can judge from the few I have witnessed, Jerdon and Stenudale are correct in their view that the mungoose usually escapes being bitten by his wonderful activity. He appears to wait till the snake makes a dart at him, and then suddenly pounces upon the reptile's head, and crunches it to pieces. I have seen a mungoose eat up the head and poison glands of a large cobra, so the poison must be harmless to the mucous membrane of the former animal. When excited, the mungoose erects its long stiff hair, and it must be very difficult for a snake to drive its fangs through this and through the thick skin which all kinds of *Herpestes* possess. In all probability a mungoose is very rarely scratched by the fangs, and, if he is, very little poison can be injected. It has been repeatedly proved by experiments that a mungoose can be killed, like any other animal, if properly bitten by a venomous snake, though even in this case the effects appear to be produced after a longer period than with other mammals of the same size."

In addition to being a benefactor to the human race as a destroyer of poisonous snakes, the Indian mungoose (like its Egyptian cousin) is equally valuable as an exterminator of rats; ships having more than once been cleared of those pests in a comparatively short period by the introduction of a mungoose. Rather more than twenty years ago (1871) the sugar-planting industry in Jamaica was threatened with annihilation from the damage inflicted on the canes by a particular species of rat, which absolutely swarmed in the island. After ferrets, toads, and ants had been tried with more or less ill-success to stay the plague, Mr. W. B. Espeut bethought himself of introducing the Indian mungoose. Accordingly, in the spring of 1872, nine of these animals were imported and let loose in the island. "Within

The small Indian mongoose (*H. auroguttatus*) is a member of the same group as the preceding species, but is of smaller dimensions, with closer and shorter fur, in which the individual hairs of the back do not have more than five coloured rings. This is a northern form, not found in India to the southward of Calcutta, and ranging into the Himalaya as far north as the valley of Kashmir, while to the westward its range includes Baluchistan and portions of Afghanistan and Persia, and eastwards it extends through Assam into Upper Burma. In Kashmir it may frequently be seen in the Mohammedan burying-places, where it inhabits old graves. Omitting mention of other uniformly-coloured Indian species, we may briefly refer to three other species inhabiting our eastern dominions. One of these is the ruddy mongoose (*H. smithi*), widely distributed in India, and distinguished by the black tip to its tail, and the absence of a stripe on the throat. The second is the stripe-necked mongoose (*H. vitticollis*), which is the largest of all the Asiatic species, and is readily distinguished by having both a black tip to the tail and a black stripe down each side of the neck. It inhabits Western India, from Bombay to Cape Comorin, and is also found in Ceylon.

The last of these three species is the crab-eating mongoose (*H. urva*), remarkable on account of its peculiar habits. In size this species (of which we give a figure) is rather smaller than the preceding one, and is characterised by its thick and heavy build, the uniformly-coloured tail, and the presence of a narrow white stripe running along each side of the neck, from the angle of the mouth to the shoulder. The crab-eating mongoose is found at low elevations in the South-Eastern Himalaya, as well as in Assam, Arakan, Pegu, Tenasserim, and the south of China. It is stated to be of partially aquatic habits, and derives its name from the crabs which, together with frogs, are asserted to form its chief food. Further information as to the habits of this species is, however, still required.

The remaining representatives of the true mongooses comprise the large Javan mongoose (*H. javanicus*) and the short-tailed mongoose (*H. brachyurus*) from the Malay Peninsula and some of the islands of the same region, and the barred mongoose (*H. semitorquatus*) from the Island of Borneo. It has already been mentioned that a few of the true mongooses have but three premolar teeth on

either side of each jaw ; such species being found only in Africa. It may be added that in these species there is always a distinct gap between the tusk or canine tooth and the premolar corresponding with the second in those species having four of these teeth. There occur, however, in Africa two small mungooses with only three premolar teeth, of which the most anterior is placed close up to the tusk, so that there is no gap in the series. These species are also distinguished from their African relatives by their proportionately shorter tails, of which the length is less than that of the body alone. Hence these two animals have been referred to a distinct genus—*Helogale*. Of the two species, the one named *H. parvula* is an inhabitant of Natal, and is of a greyish-brown colour ; while the other—*H. undulata*



THE CRAB-EATING MUNGOOSE ($\frac{1}{2}$ nat. size).

—hails from East Africa, in the Mozambique district, and has the hair of a grizzled rufous tint. Both have naked soles to the hind-feet.

THE FOUR-TOED MUNGOOSES.

Genera *Cynictis* and *Bleogale*.

In describing the typical mungooses it was mentioned that the first toes in both fore and hind-feet are of extremely small size. It might have been added that this small size of the first toe is more marked in the hind than in the fore-feet, and that in both limbs these digits appear to be of no functional use. We have now to mention three African mungooses in which this small first toe disappears either in the hind-limb alone or in both hind and fore-limbs. The whole of these species

have four premolar teeth on either side of each jaw, and are further characterised by the hairiness of the soles of the hind-feet.

The thick-tailed mungoose (*Cynictis penicillata*) is the only representative of its genus which is characterised by having four toes on the hind-foot and five on the fore-foot. This animal inhabits the Cape Colony, and is of medium size. It may be readily distinguished from all its allies by its bushy white-tipped tail, and the peculiar greyish-yellow colour of its fur, which is liable to some degree of individual variation. The other two species (*Bleogale crassicauda* and *B. puisa*) are from East Africa,—Mozambique and Zanzibar,—and are distinguished by having but four toes on both fore and hind-feet. Both species are closely allied, differing mainly in the colour of the hairs of the tail.



THE THICK-TAILED MUNGOOSE ($\frac{1}{3}$ nat. size).

THE SMOOTH-NOSED MUNGOUSES.

Genera *Rhinogale* and *Crossarchus*.

The remaining members of the mungoose group, all of which are African, differ from the whole of the preceding in that there is no median vertical groove between the nose and the upper lip. They are referred to three distinct genera, of which the two here mentioned have five toes on each foot.

Meller's mungoose (*Rhinogale melleri*) is an East African species, which is of interest not only on account of its being the sole representative of the genus to which it belongs, but also from only a single specimen (described as long ago as 1864)

having hitherto been obtained of it. It is of about the same form and size as the Egyptian mongoose, with the full number of premolar teeth, and with the soles of the hind-feet completely covered with hair as far as the roots of the toes. The tail is about equal in length to the body, and the general colour is a uniform pale brown, becoming lighter on the head, the individual hairs having but one or two rings of different colours.

The four remaining mongooses to be mentioned under this heading collectively constitute the genus *Cromarchus*, which is distinguished from the preceding by having only three premolar teeth on either side of each jaw, and likewise by the under-surface of the hind-feet being completely naked. A further distinction between the two is to be found in the circumstance that, while in Meller's mongoose



THE CUSIMANSE ($\frac{1}{2}$ NAT. SIZE).

the palate of the skull is concave, in the members of the present genus it is completely flat. All are of burrowing habits.

Of the four species, the cusimanse (*C. obscurus*), ranging in West Africa from the Camerun Mountains to Sierra Leone, and the Gambian mongoose (*C. gambianus*) of the Gambia have uniformly-coloured and grizzled fur. The former, which is figured above, is of a dull brown colour, with yellow tips to the hairs, while the latter is grey, with the hairs ringed. On the other hand, the East African species, namely, the zebra mongoose (*C. zebra*) and the banded mongoose (*C. fasciatus*), have the back banded with transverse stripes, which are narrow in the former and broad in the latter, as shown in the illustration on the next page. The zebra mongoose, which is confined to Abyssinia, is further distinguished by the rufous colour of the under-parts; while in the banded mongoose, of which the range extends from

the eastern portion of the Cape Colony to Mozambique, the colour of the under-surface of the body is grizzled grey.



THE BANDED MUNGOOSE ($\frac{1}{2}$ nat. size).

THE MEERKAT.

Genus *Suricata*.

The meerkat of the Cape Colonists, or suricate as it is frequently called by zoologists (*Suricata tetradactyla*), while agreeing with the two genera last mentioned in the absence of a groove below the nose, differs from both in having but four toes on each foot. It is further characterised by having three premolar teeth on each side of the upper jaw, and four on the lower jaw, so that the total number of teeth is thirty-six. The soles of the hind-feet are naked.

The meerkat is a small animal of slender form, with a tail of about half the length of the head and body. The fur is long and soft, of a light grizzled grey colour, with black transverse stripes across the hinder part of the back, the under-parts rufous, the head nearly white (except a black mark round the eyes), the ears black, and the tail yellowish, with a black tip. The longer hairs are broadly ringed with black and white, the white predominating. The transverse light and dark bands on the loins are formed, according to Mr. O. Thomas, by the regular arrangement of the hairs, by which the white and black rings come opposite to each other on adjacent hairs. The same writer observes that meerkats may be distinguished at a glance from all other mungoses by their elongated nose and claws, as well as by their peculiar coloration, no other species having ears differing in colour from the rest of the head.

Meerkats appear to be confined to the Cape Colony, extending at least as far

north as Algoa Bay. In regard to their habits, we may quote from Mrs. A. Martin, who, in her work entitled *Home Life on an Ostrich Farm*, states that these animals form most admirable and amusing little pets, nearly every homestead on the Karro having one or more of these creatures. In their wild state the meerkats live in colonies or warrens, burrowing deep holes in the sandy soil, and "feeding chiefly on succulent bulbs, which they scratch up with the long, curved, black claws on their fore-feet. They are devoted sun-worshippers, and in the early morning, before it is daylight, they emerge from their burrows, and wait in rows till their divinity appears, when they bask joyfully in his beams. They are very numerous on the Karro, and, as you ride or drive along through the *veldt*, you often come



THE MEERKAT ($\frac{1}{2}$ nat. size).

upon little colonies of them sitting up sunning themselves, and looking, in their quaint and pretty favourite attitude, like tiny dogs begging. As you approach, they look at you fearlessly and impudently, allowing you to come quite close: then, when their confiding manner has tempted you to get down in the wild hope of catching one of them, suddenly all pop so swiftly into their little holes that they seem to have disappeared by magic."

Although in the Cape it appears that the name meerkat is also often applied to the thick-tailed mungoose (*Cynictis*), it is the true meerkat alone which makes such a charming pet. "The quaint, old-fashioned little fellow," continues Mrs. Martin, "is as neatly made as a small bird: his coat, of the softest fur, with markings not unlike those of a tabby cat, is always well kept and spotlessly clean; his tiny feet, ears, and nose are all most daintily and delicately finished off: and the broad circle of black bordering his large dark eye serves, like the antimony of

THE MADAGASCAR MUNGOOSES.

Genera *Galidictis*, *Eupleres*, etc.

It will be convenient to allude, under the name of mongooses, to certain very curious members of the civet tribe which inhabit the Island of Madagascar. These are arranged under four distinct genera, of which the first three are nearly allied to one another, and are also related to the African mongooses, while the fourth is very different from both, and is indeed an altogether aberrant modification of the family. Most of these creatures have no recognised English titles, so that we are compelled to mention them under their scientific names.

The munguste (*Galidictis striata*) is one of two nearly-allied species characterised by having the ground-colour of the fur of a light tint, marked by longitudinal dark stripes on the body; this peculiar coloration being alone quite sufficient to distinguish these animals from all their allies. The munguste measures about 12½ inches in length, exclusive of the tail; the latter being rather shorter than the head and body. The tail is bushy in both species, and the claws are longer than in the true mongooses. In the munguste the snout is rather short, but it is more elongated in the other species (*G. vittata*).

The galidia (*Galidia elegans*), which is the only representative of its genus, differs from the munguste in having the fur of the body uniformly coloured; but the tail is ringed with black bands, the individual hairs being of one colour throughout their length. The hemigalidia (*Hemigalidia olivacea*) differs from it by the tail being of the same uniform coloration as the head and body, and also in its more pointed muzzle, and the smaller curvature of the claws.

The most remarkable of these four types of Madagascar Carnivores is, however, the *Eupleres goudoti*; its most peculiar characteristic being the very small size of the teeth and the weakness of the jaws. The teeth, of which the number is the same as in the civets (forty) are, indeed, much more like those of an Insectivore than of a Carnivore, most of them being separated from one another by spaces; the tusks,

or canines, are not longer than the front teeth, and the flesh-tooth is scarcely distinguishable from the adjacent teeth. The length of the head and body of the eupleres is about 19½ inches, the tail being about one-third of this length. The body is covered with a uniformly-coloured woolly fur, of which the general tint is olive, finely speckled with yellow; this speckled appearance being due to the individual hairs being banded with differently-coloured rings. The ears are large, the short tail is bushy, the feet, which are furnished with five toes, are remarkable for their extreme slenderness, and the claws are long and like those of the mungoses. In the young eupleres the fur of the shoulders has black transverse stripes. It does not appear that anything is known of the habits of this rare, and doubtless nocturnal, creature, but the weakness of its teeth and jaws suggests that its food consists rather of insects than of flesh.

EXTINCT CIVET-LIKE ANIMALS.

It has been mentioned, under the heading of the true civets, that remains of species belonging to that group are found low down in the Tertiary series of Europe. It may be added here that remains of mungoses, which have been referred to the typical genus *Herpestes*, are also found in these same upper Eocene and lower Miocene rocks of France. There also occur the bones and teeth of other animals more nearly allied to the lions; while others, again, appear to connect the civets with the weasels—a connection which would have been wholly unsuspected if science had only existing animals to deal with. In a later geological epoch—namely, the lower part of the Pliocene—there occurs another interesting type known as the *ictithere*, which serves so completely to connect the civets with the hyenas as to prove conclusively the close alliance of these two families of Carnivores. Before, however, proceeding to the hyenas, we must first take into consideration

THE AARD-WOLF.

Family *PROTELEIDÆ*.

Genus

The remarkable creature known to the Dutch boers of South Africa as the aard-wolf is one of those animals which have long been a puzzle to zoologists. It is evidently allied in many respects to the hyenas, but in others it is so different that it becomes a matter of exceeding difficulty to decide if it should be included in the same family. The majority of English zoologists appear, however, to be inclined to regard the aard-wolf (*Proteles cristatus*) as the solitary representative of a distinct family.

In size it has been compared to a large and "leggy" fox; while, in external appearance, the aard-wolf (which is known to the Kaffirs as the *isidawane*) somewhat resembles a rather small and thin-bodied striped hyena, but it has longer ears and a more pointed muzzle. The fur, which is inclined to be shaggy and of a woolly nature, is of a yellowish or reddish-brown colour, marked with about half a dozen transverse black stripes on the sides of the body; and there

THE AARD-WOLF ($\frac{1}{2}$ nat. size).

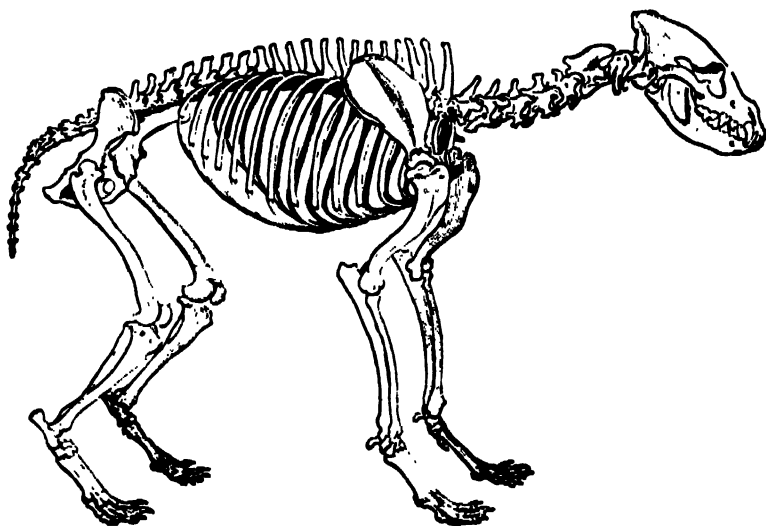
separated from one another, and are quite unlike the strongly-developed teeth of the hyenas. The skull, while agreeing in many respects with that of the hyenas, has also certain points of resemblance, with that of the mungoses. The aard-wolf may, in short, be regarded as an animal which, in all probability, originated from the same ancestral civet-like creatures from which the hyenas were derived, but which has undergone a kind of retrograde development to suit the needs of a particular mode of life. It was long thought to be confined to South Africa, but it has been subsequently found to range on the West Coast as far north as Angola, and quite recently a single skin has been obtained from Somaliland, so that it probably extends right across the Continent.

According to the accounts of all travellers through the Cape districts, it appears to be a comparatively rare animal, although this apparent rarity is doubtless in some degree due to its purely nocturnal habits. As its name implies, it lives in burrows, which are made by itself; and, according to the account of the traveller De Lalande, several individuals may inhabit one and the same burrow, which has generally at least two or three exits. Like all burrowing animals, it is of a timid and cowardly disposition, and, when driven from its burrow, makes off at a rapid pace. The aborted condition of the teeth would alone suffice to indicate that it subsisted on a diet different from that of ordinary Carnivores; and that such is really the case has been proved by observations made upon both wild and captive specimens. In the wild state it appears that its chief food consists partly of carrion, and partly of the so-called white ants, or termites, which are dug out of their hills with its strong claws.

THE HYÆNAS.

Family *HYÆNIDÆ*.

In our notice of the lion, it was mentioned that there was considerable diversity of opinion as to his character and bearing; but no such uncertainty exists with regard to the hyæna, which, by common consent, is skulking, cowardly,



SKELETON OF SPOTTED HYÆNA.

treacherous, and cruel; and, so far as we are aware, no one has ever had a good word to say for him.

Like all the animals described in the present chapter, hyænas are confined to the warmer parts of the Old World; but unlike the civets, they are unknown at the present day in Europe and in the countries lying to the eastward of the Bay of Bengal; although, in past epochs, they were spread over the greater part of

Europe, and ranged as far east as China. At no period, however, was the group represented in the Western Hemisphere.

The existing species of hyænas are three in number, all of them being now generally included in the single genus *Hyæna*; this genus forming the sole representative of a distinct family. With the exception of the aard-wolf, the nearest relatives of the hyænas are the civets; but at the present day the two families are markedly distinct, although, as mentioned on p. 479, extinct forms blend the two so closely together that it is almost impossible to say where civets end and hyænas begin. Hyænas are massively-built animals, with relatively long legs,—especially the front pair,—deep bodies, short and broad heads, and rather short tails; their whole appearance being ungainly in the extreme. Their fur is coarse

and shaggy, and marked, more or less distinctly, either with irregular vertical stripes or large blackish spots. Their feet have but four toes, on both the front and hind-limbs, and are furnished with stout claws, which are permanently protruded, like those of dogs.

Such are some of their chief external characteristics: but, in order to understand their full differences from the civet tribe, it is necessary to say something with regard to their teeth.

hyænas have a total of 34 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, $\frac{3}{4}$ pre-

molars, and $\frac{1}{4}$ molars on either side of the jaws. Thus there is but one tooth, which is of small size, behind the flesh-tooth in the upper jaw, while in the lower jaw, as shown in the accompanying figure, the flesh-tooth forms the last of the series. Here, therefore, we have an important difference from the civets,—with the single exception of the fossa (p. 449), which is otherwise well distinguished,—most of these having two molar teeth behind the upper flesh-tooth, and the whole of them having one molar behind the lower flesh-tooth. This, however, is not all, for, whereas the civet family (always excepting the fossa) have only two lobes to the blade of the upper flesh-tooth (see Fig. on p. 449), in the hyænas the same tooth (of which a figure is given on p. 353) has a three-lobed blade like that of the cats. Then, again, the lower flesh-tooth, as shown on the left side of the accompanying figure, is also quite unlike that of a civet, and closely resembles that of a cat, the only well-marked difference being the presence of a larger or smaller heel at the hinder



UPPER AND OUTER VIEWS OF THE HINDER PART OF THE RIGHT HALF OF THE LOWER JAW OF AN EXTINGUISHED HYÆNA.

The tooth on the left side of the figure is the flesh-tooth. (From the *Palaontologica Indica*.)



A GATHERING OF STRIPED HYENAS

end, although in two of the living species it has also an additional cusp on the inner side of the cutting blade. This curious resemblance of the flesh-teeth of the hyænas to those of the cats, it may be remarked in passing, is an instance of what evolutionists now call *parallelism* in development: that is to say, the resemblance has been acquired independently in the two families, since it is certain that cats are not descended from hyænas, while it is even more obvious that hyænas are not the descendants of cats.

This resemblance of the teeth of the hyænas to those of the cats is, however, confined to the flesh-teeth. Thus, in place of having but two premolar teeth in each jaw in front of the flesh-tooth, the hyænas have three of these teeth in both the upper and the lower jaw between the flesh-tooth and the canine tooth. Moreover, these premolar teeth, in place of being much compressed from side to side like those of the cats, have nearly conical and very tall crowns, as is well shown in the figure on p. 482. These strong conical premolar teeth, which are strengthened by small fore-and-aft tubercles at the base, form crushing instruments of immense power; and it is due to these teeth, aided by the flesh-teeth and the tusks, that a hyæna is able to crunch in its jaws the shin-bone of an ox almost as readily as a dog can break that of a fowl. Indeed, no carnivorous animal has jaws and teeth which can be compared for strength and bone-crushing power with those of hyænas.

THE STRIPED HYÆNA (*Hyæna striata*).

The striped hyæna, which is the only representative of the genus found in India, is one of the two smaller and less powerful species, the length of the head and body measuring $3\frac{1}{2}$ feet, and that of the tail 1 foot 6 inches. The species is characterised by its large and pointed ears, by the presence of a crest or mane of long hairs running along the middle of the neck and back, and by the long hair clothing the tail; as well as by the relatively small size of the hind, as compared with the fore-feet. In colour the striped hyæna is dirty grey, with narrow transverse tawny or blackish stripes on the body and legs.

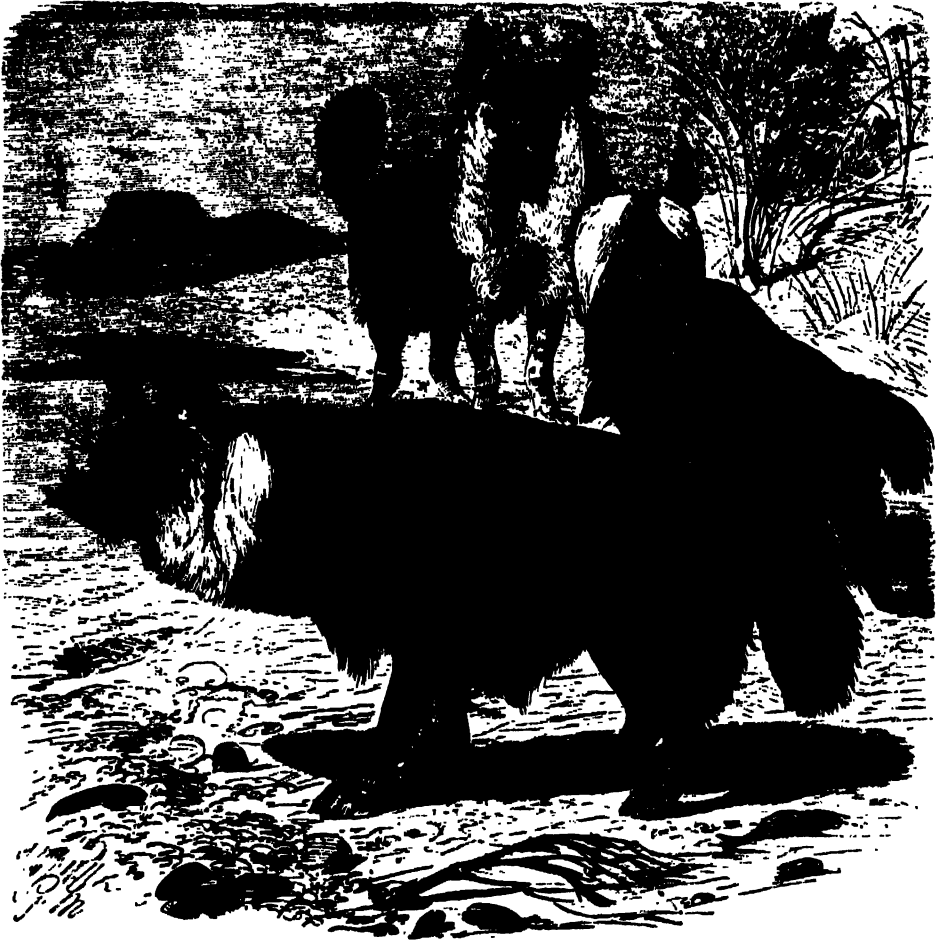
If the skull be examined, it will be found that the lower flesh-tooth differs from that of the jaw represented in the figure on p. 482, by the greater size of the heel at its hinder base, while on the inner side of the blade of the same tooth there is a small conical cusp which does not occur in the figured jaw. Moreover, in the upper jaw, the molar tooth occurring behind, or rather to the inner side of, the flesh-tooth, has a somewhat large crown, elongated in the transverse direction. In these respects the striped hyæna is less widely removed from the civets than is its cousin the spotted hyæna, and it is also somewhat less powerful in its jaws and teeth.

The striped hyæna is found throughout India, being especially common in the North-West and the Central Provinces; but it is unknown in Ceylon. From India its range extends westwards through Baluchistan into Persia and Mesopotamia, as far as the Caucasus. It is also common in Palestine, Syria, and Arabia; and the present writer on one occasion saw from the deck of a P. and O. steamer one of these animals walking on the Syrian side of the Suez Canal. From Syria it extends into Northern Africa, where it is occasionally met with in Abyssinia, but

In Syria and Palestine the favourite haunts of the striped hyæna are the rock-cut tombs so common in these countries: but in India it is more commonly found in holes and caves in rocks. Dr. Jerdon, writing of this species, says, that "I have more than once turned one out of a sugar-cane field when looking for jackals, and it very commonly lurks among ruins: but in general its den is in a hole dug by itself on the side of a hill or ravine, or a cave in a rock. The call of the hyæna is a very disagreeable, unearthly cry, and dogs are often tempted out by it when near, and fall a victim to the stealthy marauder. On one occasion a small dog belonging to an officer was taken off by a hyæna very early in the morning. The den of this beast was known to be not far off in some sandstone cliffs, and some sepoy of the detachment went after it, entered the cave, killed the hyæna, and recovered the dog alive, with but little damage done to it. A hyæna, though it does not appear to move very fast, gets over rough ground in a wonderful manner, and it takes a good long run to overtake it on horseback, unless in most favourable ground. A stray hyæna is now and then met with by a party of sportsmen, followed and speared: but sometimes not till after a run of three or four miles, if the ground is broken by ravines. It is a cowardly animal, and shows but little fight when brought to bay. The young are very tamable, and show great signs of attachment to their owner, in spite of all that has been written about the untamable ferocity of the hyæna." According to Mr. Blanford, the striped hyæna is a more silent animal than its spotted cousin: and the cries of the two species, though in some respects similar, are very different.

The striped hyæna's food is mainly carrion or carcases killed by other animals; and in inhabited districts the animal is much dreaded on account of its grave-robbing propensities. Portions of such carcases as it finds are eaten on the spot, while other parts are dragged off to its den, the situation of which is generally indicated by the fragments of bones around the entrance. These hyænas will also feast on skeletons that have been picked down to the bone by jackals and vultures; the bone-cracking power of the hyæna's jaws rendering such relics acceptable, if not favourite, food.

The striped hyæna will not unfrequently carry off sheep and goats as well as dogs. Mr. Blanford states that he has never known instances of larger prey being taken; and he supports this statement by mentioning that the live animals, tied up so frequently as baits for tigers and leopards, are never molested by hyænas, which are undoubtedly in the constant habit of banqueting on carcases of animals killed by those cats. Canon Tristram relates, however,



THE BROWN HYÆNA ($\frac{1}{12}$ nat. size).

that in Palestine a donkey belonging to one of his servants was killed by a hyæna while the owner was sleeping alongside.

The striped hyæna—probably on account of its “body-snatching” propensities—is cordially detested by the natives of all the countries it inhabits. When a hyæna is killed, the body is treated in many parts of India with every mark of indignity, and finally burnt. On one occasion in the Punjab the present writer came across a party of natives cruelly ill-treating a nearly full-grown hyæna, which had been rendered helpless by its jaws being muzzled and its feet broken.

Needless to say, the sufferings of the poor brute were soon terminated by a bullet. Although, owing to their nocturnal habits, hyænas are seldom seen, yet in some parts of India, from the multitude of their tracks, they must be very common. These tracks, as Mr. Blanford observes, are like those of a dog, from which they may, however, be distinguished by the small size of the prints of the hind as compared with those of the fore-feet.

THE BROWN HYÆNA (*Hyæna brunnea*).

The brown hyæna is far less well known than either of the other living species. Although in most respects more nearly allied to the striped hyæna, it exhibits some points of affinity with the spotted species. It is characterised by the long mantle of coarse hair, depending from the neck and back, and reaching below the belly, as is well shown in our illustration on p. 487. The ears are long and pointed, and the tail is short and bushy. The general colour of the long hair is uniform dark brown, with lighter brown or whitish patches on the legs; while the head is dark greyish-brown, and the forehead black, sprinkled with whitish or reddish-brown. The long hair of the back is whitish-grey at the root, and blackish-brown above. The legs are striped. In size this species is about the same as the striped hyæna.

The brown hyæna is a South African species, ranging on the East Coast as far as Kilima-njaro, while on the west side it may extend as far north as Mossamedes. It does not ever appear to be found at any great distance from the coast. It is doubtless this species, referred to by Mr. H. H. Johnston as the striped hyæna, which is common on the flanks of Kilima-njaro, up which it ascends to a considerable elevation; the spotted hyæna being confined to the plains. In its preference for rocky spots in that district it, therefore, resembles the striped hyæna.

THE SPOTTED HYÆNA (*Hyæna crocuta*).

The African spotted hyæna is by far the largest and most powerful of the three living species, differing from the others not only in several structural features, but also by its habit of associating in packs, and of giving utterance more frequently to its unearthly cry.

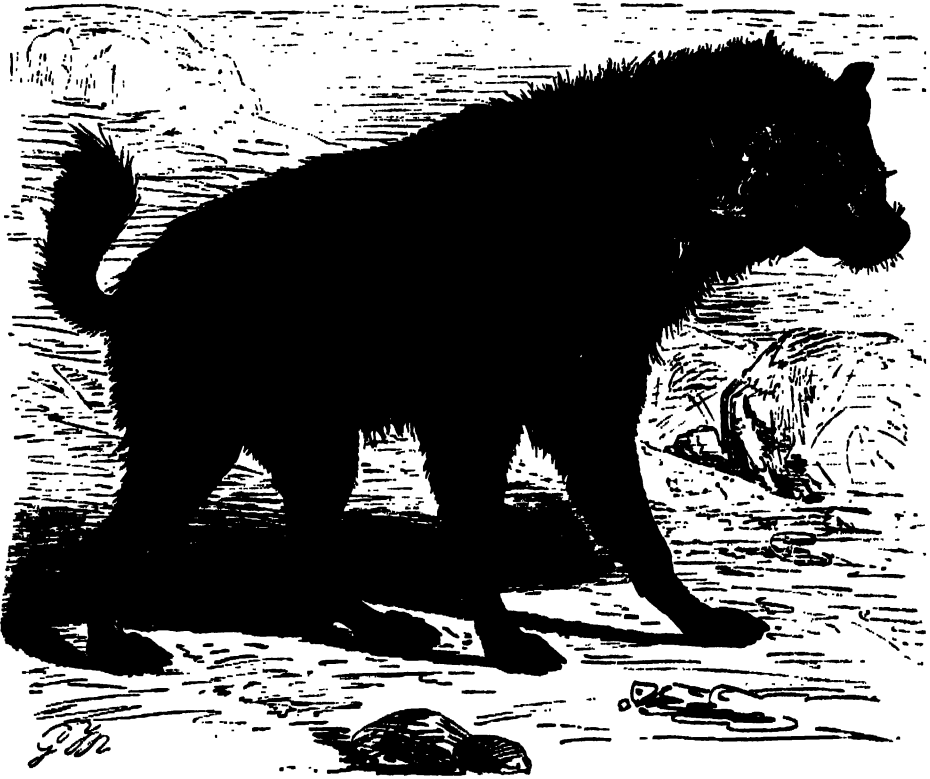
Externally the spotted hyæna is distinguished by its rounded and moderate-sized ears, by the absence of a crest of long hairs along the neck and back, and the shorter and less hairy tail. Moreover, the hind feet are relatively larger in proportion to the fore-feet, and the front and hind-legs are more nearly equal in length; the hind-limbs being less bent than in the other species. The ground-colour of the fur of the body is yellowish, and upon it are dark brown spots; the front of the face and the lower portions of the limbs being also dark.

In addition to certain structural features of the soft parts, into the consideration of which it would be out of place to enter here, the spotted hyæna is distinguished by the characters of its teeth. As these have been already partially described (p. 485), it will suffice to mention that the upper molar-tooth, situated on the inner side of the exceedingly elongated flesh-tooth, has a very

small and nearly round crown, and that it is inserted only by a single root, whereas the corresponding tooth of the striped species has two distinct roots. Then, again, the lower flesh-tooth resembles that of the jaw figured on p. 482, in the small size of its posterior heel, and also in the absence of a cusp on the inner side of the blade.

Owing to the disproportion in the length of the hind and fore-legs being much less than in the striped hyæna, the gait of the spotted hyæna is far less ungainly and awkward-looking.

The spotted hyæna occurs throughout Africa south of the Sahara, ranging on



THE SPOTTED HYÆNA ($\frac{1}{4}$ nat. size).

the eastern side of the continent into Abyssinia and Nubia. At one time it was very abundant in the Cape Colony, and Sir Samuel Baker bears testimony as to its numbers on the Upper Nile in the neighbourhood of Kassala, while Mr. H. H. Johnston attests its common occurrence on the plains around Kilima-njaro. Formerly, however, the geographical range of this hyæna was far more extensive than it is at present, as is proved by the vast quantities of its remains found in the caves of various parts of Europe, from Gibraltar in the south to Yorkshire in the north. It was formerly considered, indeed, that the so-called "cave-hyæna" indicated a distinct species from the living one; but zoologists are now generally in accord in regarding the two as specifically

Sir Samuel Baker describes the midnight visit of a hyæna to his tent, when on the Upper Nile, in the following words:—"I was asleep in my tent, when I was suddenly awakened by a slight pull at my sleeve, which was the signal always given by my wife if anything was wrong. . . . She now whispered that a hyæna had been within the tent, but that it had just bolted out, as these animals are so wary that they detect the slightest movement or noise. As a rule, I never shoot at hyænas, but, as I feared it might eat our saddles, I lay in bed with the rifle to my shoulder, pointed towards the tent door through which the moon was shining brightly. In a few minutes a grey-looking object stood like an apparition at the entrance, peering into the tent to see if all were right before it entered. I touched the trigger, and the hyæna fell dead."

The Hon. W. H. Drummond, referring to the spotted hyænas of South-East Africa, notices the damage these animals do to cattle, more especially cows; and then mentions certain instances where they have attacked human beings. "Cowardly when there is the faintest suspicion of danger, daring when there is none, stealthy and cunning to the last degree, and provided with great powers of scent and hearing, added to immense strength, there is no animal so universally hated, or that causes more trouble and annoyance to both hunters and the peaceful natives." Common as they are in South-East Africa, spotted hyænas are, however, but very seldom seen, as they are quite as nocturnal as their striped cousin, retiring to their holes at the earliest dawn. "Regular beaten paths," he continues, "lead to these burrows, along which they invariably go, both when coming out and

returning; indeed, unless they scent food, they always make use of paths in their nocturnal rambles, whether made by themselves or by men or game. In a primitive state there is no doubt that they are chiefly dependent upon the lion for their daily food, and it is equally certain that they must be able to go without eating for immense periods. The old hunters declare that their numbers have much increased within their memory in the districts in which there is most hunting, and as so much game goes away and dies unseen of its wounds, which the hyænas are easily able to find by the blood-track which they leave, to say nothing of the amount of meat that is purposely left for want of a use for it, there is every reason to think that they must find man a better purveyor than the lion, and increase accordingly."

EXTINCT HYÆNAS.

The occurrence of fossil remains of the spotted and striped hyænas in the cavern and other superficial deposits of Europe has been already mentioned. In the antecedent Pliocene period there were, however, a number of hyænas belonging to species now extinct; some of these being nearly allied to the existing forms, while others differed markedly in the number and characters of their teeth. These extinct hyænas are found over the greater part of Europe—from France to Italy, Greece, and Hungary—and also in Persia, India, and China. Colvin's hyæna from North India, of which a portion of the lower jaw is figured on p. 482, and the robust hyæna of Italy were nearly allied to the spotted species, while the Pikermi hyæna of Greece differed from all living species in having four premolar teeth in the lower jaw. The Siwalik hyæna of Northern India and the Grecian hyæna were allied to the striped species, but both have an additional molar behind the lower flesh-tooth, while the former has four lower premolars. Again, the long-jawed hyæna from Northern India and a nearly allied species from Greece differ from existing forms in their long jaws and the compressed form of the premolar teeth, of which there were four in the lower jaw. These two species make a marked approach to the civets, but this is still more evident in a smaller extinct hyæna from Europe, referred to a distinct genus under the name of *Palhyaena*. In this there were four premolar and two molar teeth in each jaw, so that the total number of teeth was forty, or the same as in the true civets, and this extinct species was so nearly allied to the extinct civet mentioned on p. 479 as the *ictithere*, that the two families may be regarded as passing one into the other.

CHAPTER XV.

CARNIVORES,—*continued.*

THE DOG TRIBE.

Family *CANIDÆ*.

UNDER the general title of Dogs may be included all the animals commonly known as wolves, jackals, foxes, and wild dogs, together with the various breeds of domestic dogs. These collectively constitute the family *Canide*, and form a group in some respects intermediate between the Carnivores treated in the two preceding chapters, and those described in the three succeeding ones. The Dog family must always have an especial interest, since it includes the animals which have become more thoroughly the friends and companions of man than any other creatures. The origin of the domestic dogs is, however, shrouded in the mist of antiquity, and it is still an open question whether the various breeds are descended from a single wild stock, or whether they are the product of several species.

The Dog family, as thus constituted, forms, at the present day, a compact and well-defined group, the wild members of which cannot be confused with those of any other. The whole of them are characterised by their long and pointed muzzles, their moderately long tails, and their perfectly digitigrade feet, furnished with blunt, nearly straight, and non-retractile claws. Then, again, all the dogs have but four toes on the hind-feet, while, with the exception of the African hunting-dog, the number of toes on the fore-feet is five, of which the first, or innermost, is shorter than either of the others, and does not touch the ground. The limbs, although varying in relative length, are never so short in proportion to the body as is the case in so many of the Civet family. The ears are pointed and erect, but vary greatly in length in the different groups. Such are some of the chief external characteristics of the dogs, but, in order to understand their distinction from other families of Carnivores, it is essential to pay attention to the skull and teeth. In all dogs the skull, as shown in the figure on p. 352, is characterised by its elongated muzzle and the large number of teeth with which it is furnished; in both of which respects it is widely different from the skull of the cats. On the under-surface of the hinder part of the skull the tympanic bulla is inflated and bladder-like, although it is not divided into two chambers by a complete septum. This part of the skull serves, therefore, to distinguish the dogs from the Carnivores yet mentioned, with the exception of the hyænas. From the hyænas, as well as from the cats, the dogs are readily distinguished by the number and structure of their teeth. With but few exceptions, the total number of their teeth is 42, or two more than the true civets; the series consisting of

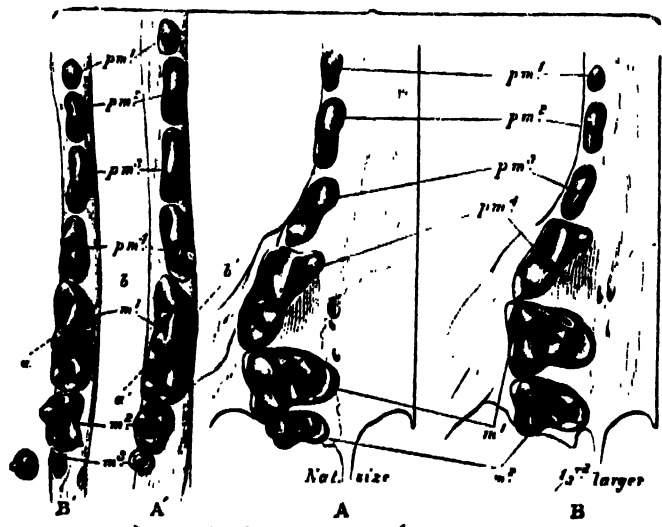
$\frac{3}{4}$ incisors, $\frac{1}{2}$ canines, $\frac{4}{4}$ premolars, and $\frac{2}{2}$ molars. If this formula be compared with the one given on p. 449, it will be seen that the excess in the number of the teeth of a dog over those of a civet is owing to the presence of an additional pair of molars in the lower jaw. This will not, however, serve to distinguish between all the dogs and the civets, since the Indian wild dogs have but two pairs of lower molars. In all cases there are four premolar teeth on each side of both jaws. The cheek-teeth of the dogs are constructed on the same general plan as those of the civets, the upper flesh-tooth having but two lobes to the blade, while the lower flesh-tooth has a large heel posteriorly to the cutting-blade; this heel being, however, relatively smaller than in the civets. In both dogs and civets, the molars of the upper jaw have the same general triangular form. A good idea of the characters of the cheek-teeth of the dogs will be gathered from the accompanying figure, while the skull represented on p. 352 shows the lateral aspect of the whole dental series.

There are other characters connected with the skull, together with many points in the structure of the soft parts, which afford additional means of distinguishing the dogs from other Carnivores, but the above are sufficient to define the group, so far as living forms are concerned.

In their general uniformity of structure and outward appearance, the

dogs differ widely from the civets, and more nearly resemble the cats. There is a considerable amount of difference in external appearance between a fox and a wolf, but intermediate forms connect them so closely that they are generally considered as members of a single genus. On the other hand, three members of the family differ so remarkably from all the rest, and also from one another, that they are regarded as the representatives of as many genera. Some diversity of opinion exists as to the advisability of also referring the Asiatic wild dogs to a distinct genus, but they are here classed in the typical genus *Canis*. We thus have the whole of the existing members of the family ranged under four genera, of which the last three are severally represented by a single species.

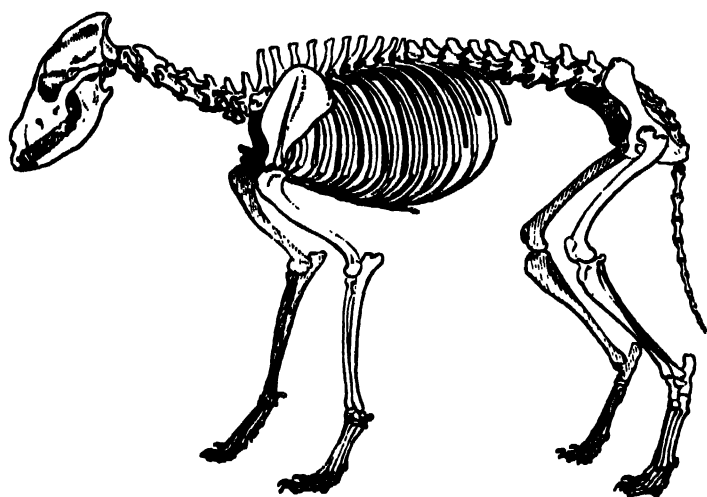
With the marked exception of the Cape hunting-dog, all the members of the family are characterised by their more or less uniform and sombre coloration; in



THE RIGHT UPPER AND LOWER CHEEK-TEETH OF THE COMMON FOX (A, A') AND OF AZARA'S FOX (B, B').

The letters *p.m.* 1 to *p.m.* 4 indicate the premolar, and *m.* 1 to *m.* 3 the molar teeth; *p.m.* 4 in the upper and *m.* 1 in the lower jaw, being the flesh-tooth. In *m.* 1 of the lower jaw *b* indicates the hinder lobe of the cutting-blade, and *a* its inner cusp. (From *Proc. Zool. Soc.* - After Huxley.)

which respect they are markedly different from both the civets and the coatia. The general coloration of the dogs varies from grey to a yellowish or reddish-brown; the upper-part of the head and back, as well as some portions of the limbs, being generally darker than the flanks, while the under-parts are paler. The outer surfaces of the ears may be distinctively coloured, and there is often a dark mark between the eye and the nose, and another near the tail; but, as a rule, stripes or patches differing in hue from the ground-colour of the fur are absent, or ill-defined. In spite, however, of this general uniformity of coloration, many of the species are subject to an extraordinary amount of either individual or seasonal variation, both in respect of colour, and also as regards the length of their fur. In consequence of such variations much uncertainty has prevailed as to the number of species. Professor Mivart gives the probable number as thirty-five, but he reckons a few forms which other writers do not consider entitled to rank as more than



SKELETON OF WOLF.

varieties, while some of the forms which he considers to be varieties are regarded as species by others. The total number may, therefore, be roughly estimated at a little below forty.

As regards the seasonal and individual variation in the coloration of dogs, it may be observed that the hue of the fur is generally lighter in winter than in summer; this

difference attaining its maximum in the Arctic fox, of which the usual winter pelage is pure white. Then again, among those species or races inhabiting high latitudes or mountains, the fur is considerably longer in winter than in summer. Moreover, as with the cats, some species show more or less marked tendencies to the development of black individuals. Again, and especially among the foxes, the colour of different individuals or races of a single species may vary from a greyish, through a yellowish, to a reddish tinge: while, if the general colour remains the same, there may be darker or lighter shades. Added to these variations in the coloration and length of the fur, there may also be a large amount of individual difference in point of size in the same species.

A peculiar character of many dogs, and one in which they differ markedly from the cats, is their habit of associating in large packs for the purpose of hunting their prey. In general, such prey is pursued chiefly or entirely by the aid of smell, which attains an extraordinary development in some members of the group. This keen perception of scent is not, however, accompanied by any

deficiencies in the senses of sight and hearing, both of which are also highly developed. It is probably due to this habit of associating in packs that many of the dogs are, to a greater or smaller extent, diurnal; but the majority are also in part nocturnal. From the nature of their claws, no dogs are fitted for climbing trees; and none are especially adapted for an aquatic life, although several of the domestic breeds are excellent swimmers. The cry of the various species of wild dogs varies greatly, but may generally be termed a howl rather than a bark, although some utter a kind of yelping bark. Apparently, all the species can be tamed to a certain degree, although the extent to which this taming can be carried out varies in different species, and even in different individuals of the same species. All wild dogs are in the habit of living in burrows, in the clefts of rocks, in caverns, or hollow trees. Some species, like the fox, excavate burrows for themselves, while others take advantage of the deserted holes of other animals; and whereas some dogs dig solitary burrows, others excavate them close together, so as to form a colony, or warren. The number of young in a litter is said to vary from three to as many as a dozen; and it is believed that in all cases the cubs or "pups" are born blind. Several of the wild species, like the jackal and the wolf, will freely interbreed; and the hybrid offspring between either of these species and domestic dogs are known to be fertile.

As regards their geographical distribution, the dogs are more widely spread than any family of Carnivores yet noticed; and in this respect they are only approached by the weasel family. This wide distribution is the more remarkable when the uniformity in the organisation and external appearance of the members of the group are taken into consideration. The great majority are to be found in the northern hemisphere, in which one is common to both Europe and North America. A single species, the dingo, is now found wild in Australia, but no wild dogs occur in either Ceylon or Madagascar.

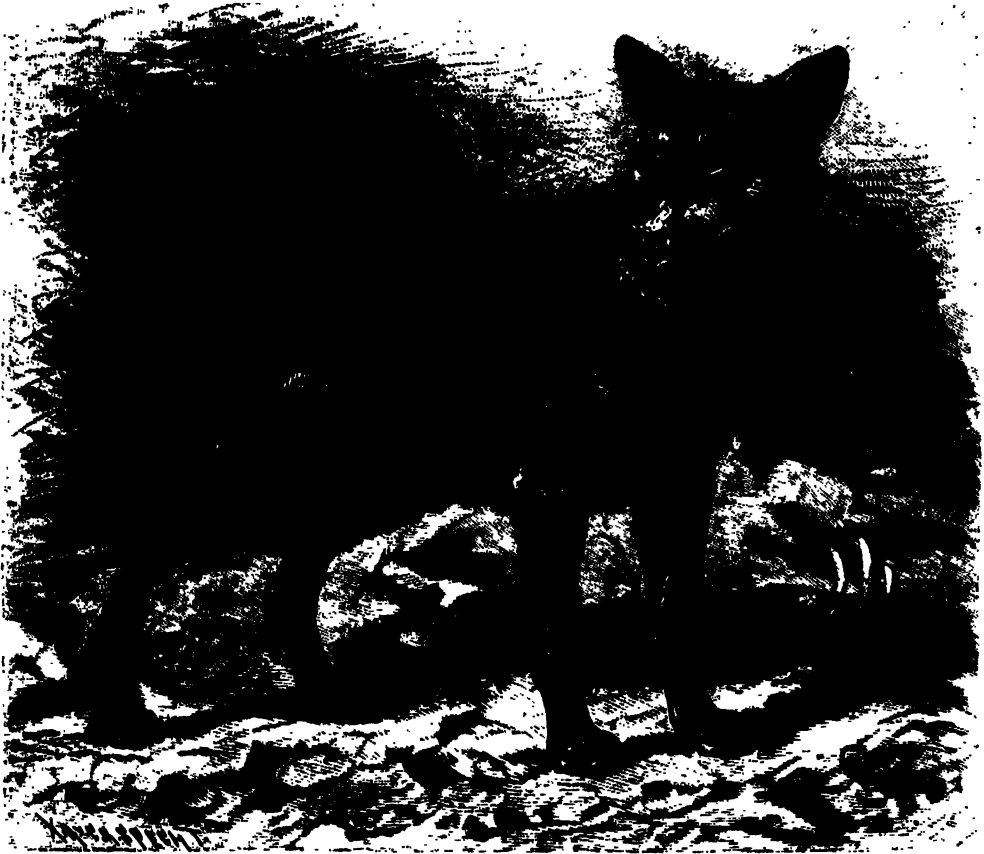
In disposition and the nature of their food many of the dogs show marked differences. Thus, whereas the European wolf, which hunts in packs, and is exceedingly fierce, will attack both human beings and cattle, the solitary South American maned wolf is a timid and comparatively harmless animal, except to the small creatures upon which it preys. Again, whereas the majority of species are more or less purely carnivorous, and kill their own prey, the jackal lives largely upon carrion; while other species will devour lizards, mice, and even snails, and insects. Others, again, will eat marine mollusks and crustaceans, while the Arctic fox subsists largely upon fish, as does the domestic Eskimo dog.

As already mentioned, with the exception of three species, forming the types of as many genera, the whole of the existing members of the Dog family are included in the genus *Canis*. In all these forms there are five toes in the hind feet; and, with the exception of the Asiatic wild dogs, there are three molar teeth on each side of the lower jaw.

THE WOLF (*Canis lupus*).

If we exclude some of the breeds of domestic dogs, the wolf is the largest living member of the family; and its reputation for fierceness is too well

known to need more than passing mention. It belongs to a group which includes the other wolves, the jackals, and the domestic dogs; all the wild species of which are characterised by their powerful teeth, the moderate brush formed by the tail (in which the hair is longer than that of the body), and by the pupil of the eye being round. Moreover, in the skull of all these animals the bony projection forming the hinder border of the socket of the eye is regularly curved downwards and has a convex upper surface; whereas in a fox the same process is hollow above, and has a more or less marked tendency to curve upwards behind.



THE WOLF ($\frac{1}{2}$ nat. size).

With the exception of the Antarctic wolf of the Falkland Islands, true wolves are restricted to the northern hemisphere, being unknown both in Africa and South America. The European wolf measures about $3\frac{1}{2}$ feet in length, exclusive of the tail, and is characterised by having a woolly under-fur of a slaty-brown colour. The prevailing hue of the fur is typically of a rufous or yellowish-grey above, which may be more or less mingled with black; while the under-parts are whitish. The tail, which is considerably less than half the length of the head and body, may be tipped with black. From this ordinary type of coloration there may be varia-

tions, owing to the development of a more or less marked grey or red tinge; while in some cases the fur may be much paler than usual, and in others nearly or quite black. In Europe the light-coloured varieties appear to be characteristic of northern, and the dark of southern regions, black or blackish wolves being not uncommon in Spain. As in Europe there is a black race of the ordinary wolf, so black specimens of the woolly variety occur in Tibet; these animals having shaggy fur of a uniform black colour, except the muzzle, feet, and patch on the chest, which are white. More uncertainty has prevailed as to whether the Japanese wolf (*C. hodophylus*) is distinct from the European form; the Indian wolf is regarded, however, by Mr. Blanford (although not by Professor Mivart) as entitled to rank as a separate species.

The North American wolf has frequently been regarded as specifically distinct from the European one, under the name of *C. occidentalis*. Dr. C. H. Merriam has, however, long regarded the two forms as specifically identical, and the same view is taken by Prof. Mivart. The latter writer observes that although the fur of most American wolves is less red than is generally the case with European specimens, especially on the legs and the hinder-part of the head, yet North European examples have a nearly similar coloration. Then, again, the American skins generally have more black on the back than most European ones; but this tendency to blackness is still more marked in Spanish wolves. As in Europe, there is in America great individual and racial variation in the colour of the wolf. Thus, according to Mr. S. F. Baird, there is a pure white wolf on the Upper Missouri, a dusky blackish wolf on the Lower Missouri, a black wolf in Florida and the Southern United States, and a red wolf in Texas. There is, moreover, considerable difference in respect of size and shape; the southern wolves being smaller, more slender, and more "leggy" than those from the extreme north; while they have also shorter and closer fur. The southern limit of the wolf in America is the State of Guanajuato, in Mexico. Including, then, the whole of the varieties mentioned above, with the exception of the Indian wolf, under a single specific title, the range of the common wolf will be very extensive; and will embrace the whole of Europe, the greater part of Asia to the northward of the Himalaya, and as far east as Japan, and nearly the whole of North America.

In Europe the wolf has disappeared from Britain and Central and Northern Germany, but still lives in the wilder or more mountainous districts of the rest of the Continent, being especially abundant in many parts of Russia—both European and Asiatic. Wolves were formerly abundant in the British Islands: in Yorkshire they were common in the reign of Richard II.; while in the time of Cromwell parts of Ireland were much infested by them. Mr. Harting states that the wolf became extinct in England during the reign of Henry VII.; that it survived in Scotland until 1743; and that the last was killed in Ireland, according to Richardson, in 1770, or, according to Sir J. E. Tennent, subsequently to 1766.

In America, owing to the rapid spread of cultivation, wolves are disappearing, or becoming scarce in all but the wilder districts. Prof. Mivart, from data supplied him by American naturalists, states that at the present day the wolf is found east of the Mississippi and south of Canada only in the still nearly unsettled parts of the country, as the northern portion of New England and New York, portions of

the attacks of wolves, when in packs, upon travellers in Russia are so numerous, and have been so frequently quoted that it will be unnecessary to repeat any of them here; but it may be mentioned that in the year 1875 no less than 161 persons fell victims to these animals in Russia. Writing of the wolf of the Adirondack region, Dr. Merriam observes that during the deep snows a small pack of wolves will sometimes kill hundreds of deer, taking here and there a bite, but leaving the greater number untouched. In the earlier days of American farming, a couple of these marauders have been known to kill fifteen or sixteen sheep in a single night, simply tearing open their throats without otherwise damaging the carcasses. When the bison existed in countless thousands on the prairies of North America, wolves were in the habit of prowling around the herds for the purpose of preying on sick or wounded individuals and such calves as strayed from the protection of their elders. Frequently, it is stated, wolves might be seen wandering in the midst of a herd of bull bison without attracting the least attention. In general almost any kind of prey is acceptable to the wolf, which does not by any means disdain a meal of carrion. The larger mammals, such as cattle, horses, and the bigger kinds of deer, are generally only attacked when several wolves are associated together; but it is stated that in Canada a single wolf will kill the largest male reindeer. Birds always form an acceptable portion of the wolf's diet. When hard pressed by hunger, wolves will eat almost anything they come across, down to mice and frogs, and, it is said, even buds of trees and lichens.

The lair of the wolf is formed either in a rocky cavern, within the hollow of a fallen trunk, beneath the roots of an overthrown tree, or more rarely in holes in the ground; such burrows being sometimes dug by the animal itself. A dense thicket will also not unfrequently serve as a hiding-place. In these lairs the cubs are born, the number in a litter generally varying from six to ten. The cubs, which are born in the spring, usually remain with their parents till the end of November or December, but may sometimes continue with them for a much longer period. The ordinary cry of the wolf is a loud and prolonged howl. The amount of noise, writes Dr. Merriam, that a single wolf is capable of producing is simply astonishing; and many amusing episodes of camp lore owe their origin to this fact. More than one lone traveller has hastily taken to a tree, and remained in the inhospitable shelter of its branches for an entire night, believing himself surrounded by a pack of at least fifty fierce and hungry wolves, when in reality there was but one, and (as its tracks afterwards proved) that was on the further side of a lake, a couple of miles away. By association with domestic dogs, wolves will soon learn to

bark. They will breed freely with the larger kinds of domesticated dogs: and it is stated that some of the Indians in the north of America improve the breed of the sleighing dogs by crossing with the wolf.

The endurance of the wolf's gallop has become proverbial. "When pursued by wolves," writes Mr. Lett, "deer make for the nearest water, in which they have a chance to escape, being able to swim much faster than their enemies. Should the river or lake be narrow, the deer generally swim either up or down, seldom straight across: frequently landing, after a detour, on the same side in which they entered the water. By this means the wolves are puzzled and put off the scent. If there are thick weeds or bush along the shore, the deer frequently sinks his body under water, so that no part will appear above the surface but his head, and by this means is enabled to evade the cunning of his pursuers." The wolf displays remarkable caution in avoiding all kinds of traps set for his destruction: and when he is caught will frequently feign death in the hope of being able to escape.

Fossil remains of the wolf occur in the caverns and superficial deposits of England and the Continent: the earliest horizon from which they have been obtained in this country being the so-called forest-bed of the Eastern Coast, which antedates the glacial period.

THE INDIAN WOLF (*Canis pallipes*).

As already mentioned, there has been much discussion as to whether the Indian wolf is distinct from the common species. According to Mr. Blanford, it is distinguished from the common wolf by its smaller size and slighter build, as well as by its shorter fur, which has little or no woolly under-fur. The length is about 3 feet, exclusive of the tail; and the general colour of the fur is a greyish fulvous, usually with a brownish tinge, and sometimes with more or less black on the back. Occasionally, however, a more or less strongly marked rufous tint may be observed. Mr. Blanford states that all the skins that have come under his notice are browner than is usually the case with the common wolf, and are of an earthy-grey colour.

The Indian wolf is confined to India south of the Himalaya. It is rare in Lower Bengal, and unknown on the Malabar coast; and it appears to be replaced by the common species to the west of the Indus, although a few examples are occasionally seen in the Trans-Indus districts. The young are born in holes or caves among rocks during the months of October, November, and December, the number in a litter varying from three to eight.

Its habits are very similar to those of the common species; but, although somewhat gregarious, these wolves do not associate in large packs, six or eight being the largest number that have been seen together. Moreover, it appears to be a rather silent animal, rarely, if ever, howling like the common wolf, but, according to Jerdon, sometimes barking like a pariah dog. Its food includes such mammals and birds as it can kill, but sheep, goats, and antelopes appear to be the chief favourites. On occasion these wolves will attack adult human beings, for which purpose two or more will combine together; and in certain

districts a large number of children are annually carried off by them from the villages. In the South Mahratta country, Sir W. Elliot writes that he has seen a small pack "steal round a herd of antelope, and conceal themselves on different sides till an opportunity occurs of seizing one of them unawares, as they approach, whilst grazing, to one or other of their hidden assailants. On one occasion three wolves were seen to chase a herd of gazelles across a ravine in which two others were lying in wait. They succeeded in seizing a female gazelle, which was taken from them. They have frequently been seen to course and run down hares and foxes, and it is a common belief of the peasants that in the open plains, where there is no cover or concealment, they scrape a hole in the earth, in which one of the pack lies down and remains hidden, while the others drive the herd of antelopes over him. Their chief prey is, however, sheep."

THE COYOTE (*Canis latrans*).

Whatever doubt there may be as to the right of the Indian wolf to specific distinction, there can be none in the case of the coyote, or prairie-wolf, of North



THE COYOTE (11)

America. This animal is considerably smaller than the common wolf, from which it is also distinguished by its thicker and longer fur and more bushy tail. On

account of this greater length of the fur, the coyote appears to be a thicker built and shorter-legged animal than it really is. The colour varies considerably at different seasons of the year, being of a bright fulvous brown in summer, and grey or greyish in winter: this ground-colour at both seasons being overlaid with a shading of black, which tends to form stripes along the back and across the shoulders and loins. The under-parts are of a dirty white tint; while the upper portion of the muzzle, and the outsides of the ears and legs, are generally tawny. The coyote ranges from the south of Costa Rica, in Central America, to the lower portions of Hudson's Bay. It is still abundant in Texas and Northern Mexico, but is rare in Guatemala; and it has been suggested that it is but a comparatively recent immigrant into Central America.

The coyote is more generally in the habit of burrowing in the ground than the common wolf; it is also far less savage and destructive, and becomes more docile and gentle in captivity. Like the common wolf, it will on occasions hunt in packs; and it is at least as noisy an animal, although the tone of its howl is quite different. As regards food, it appears to be almost omnivorous; and, when an animal diet is unattainable, it will feed upon juniper-berries, or the prickly pear. Rabbits, rats, young birds, etc., form, however, its staple diet; and it does not appear that it ever attacks the larger mammals, although, when wounded and brought to bay, it will defend itself fiercely. In speed it is far inferior to the wolf, and it can be readily overtaken by a good horse. The cubs are born in May and June; the number in a litter usually being five or six, but occasionally ten.

THE ANTARCTIC WOLF (*Canis antarcticus*).

Seeing that no true wolf is found in continental South America, it is strange to meet with a small species, apparently nearly allied to the coyote, inhabiting the Falkland Islands. The antarctic wolf is rather smaller than the larger individuals of the coyote, and has shorter fur and a less bushy tail. The general colour is yellowish mingled with black, the individual hairs being yellow at the base, with black tips: the fur of the under-parts is whitish. White is also the colour of the fur on the lips, chin, and throat, as well as on the inner margins of the ears. The most characteristic coloration is, however, that of the tail, in which the first two-fifths are of the same hue as the body, the next two-fifths black, and the remainder white.

The antarctic wolf was discovered by Pernety during his voyage in the years 1763 and 1764, and was again observed by Commodore Byron of H.M.S. *Dolphin*, who circumnavigated the world in 1767. Darwin, who saw them during the voyage of the *Beagle*, writes that "these wolves are well known, from Byron's account of their tameness and curiosity, which the sailors, who ran into the water to avoid them, mistook for fierceness. To this day their manners remain the same. They have been observed to enter a tent, and actually pull some meat from beneath the head of a sleeping seaman. The Guachos also have frequently in the evening killed them, by holding out a piece of meat in one hand, and in the other a knife ready to stick them. As far as I am aware, there is no other instance in

any part of the world of so small a mass of broken land, distant from a continent, possessing so large an aboriginal quadruped peculiar to itself. Their numbers have rapidly decreased; they are already banished from that half of the island which lies to the eastward of the neck of land between St. Salvador Bay and Berkeley Sound." These wolves do not associate in packs, are largely diurnal, and are usually silent, except during the breeding season. They burrow in the ground, and prey on geese and penguins, but are now nearly exterminated.

THE KABERU (*Canis simensis*).

The kaberu, or Abyssinian wolf, is a little-known species, taking its Latin name from the district of Simen, or Semyen, in Abyssinia, where the first specimen brought to Europe was obtained. Although of about the same size as the coyote, it has no claim to be regarded as a true wolf; and may rather be looked upon as an abnormal kind of jackal, in which the size of the body, and notably that of the jaws, has increased, without any corresponding enlargement of the teeth, which are far smaller than in the true wolves. The kaberu, which inhabits mountainous districts, has an extremely long and narrow snout, larger ears than the true wolves, and a thick bushy tail like that of a jackal. Its general colour is a light reddish brown with a tinge of yellow; the mouth, chest, under-parts, and the front of the lower portions of the legs being whitish. The greater part of the upper surface of the tail is mottled with black, and its end is of that colour.

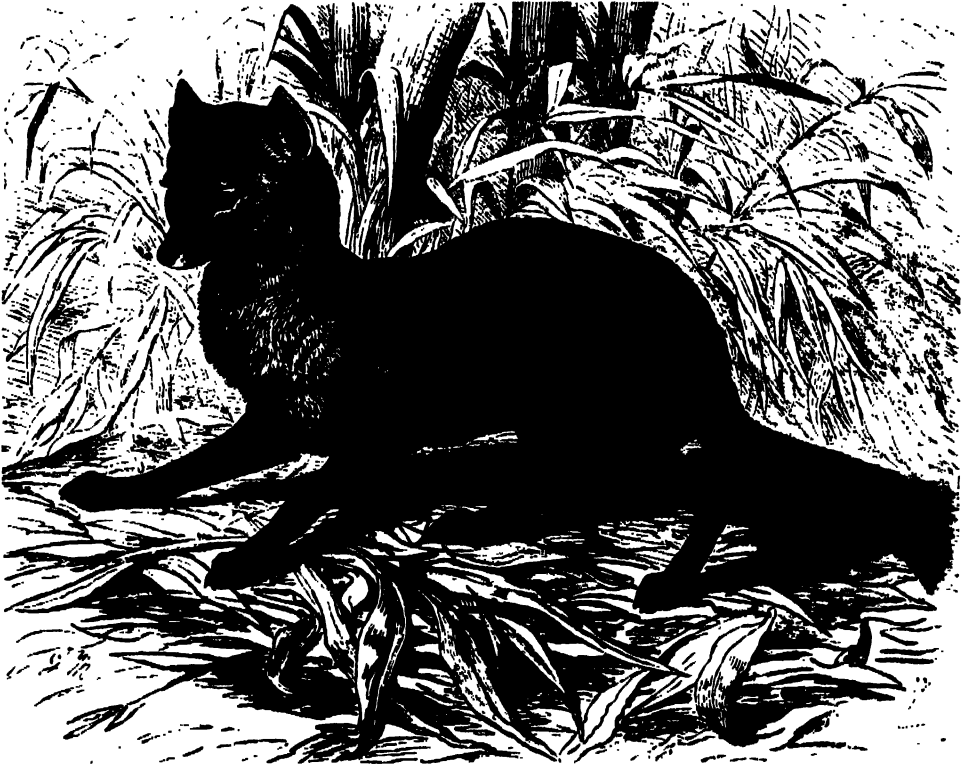
THE JACKAL (*Canis aureus*).

With the common jackal we come to the first of a group of species of smaller size than the true wolves, with which they are to some extent connected by the one last described. Their bushy tails are relatively shorter than in the wolves, being generally equal to about one-third the length of the head and body; and their skulls may be distinguished by the smaller size of the flesh-teeth as compared with the molar teeth behind them. As in the case of the wolves, there is some difference of opinion as to the specific identity of the jackals of different countries. The Asiatic jackal is subject to considerable individual variation in point of size; the length of the head and body varying from 2 to 2½ feet. Its general colour varies from a pale isabelline to a pale rufous, with a larger or smaller admixture of black on the upper-parts. The under-parts are paler, and the muzzle, ears, and the outer sides of the limbs more rufous than the rest. The reddish brown hairs of the tail have long black tips, thus forming a distinct black tip to the tail itself. The African variety is of rather larger size, with relatively longer ears; and the sides of the body are greyer, and the outer surfaces of the limbs less rufous. Occasionally rufous, black, and white varieties of the jackal have been met with; the latter being true albinos.

The jackal ranges from the south-eastern countries of Europe to India and Ceylon; thence it extends through Assam to Northern Pegu and the neighbourhood of Mandalay, although it is much less common east of the Bay of Bengal than in India. In Northern Africa it inhabits Egypt and Abyssinia, and the districts to

the north of the Sahara. In the Himalaya it ascends to from three to four thousand feet above the sea-level. Throughout India it may be found indifferently in hilly or plain country, in forest or open districts, or in large cities.

Although jackals are frequently in the habit of going singly or in pairs, they often associate in packs, which may be of considerable size; these assemblages being more frequent at night than during the daytime. In India the jackal is considered by Mr. Blanford to be a more decidedly nocturnal animal than the wolf, but its wanderings are by no means confined to the night; and, during the winter, jackals may be seen abroad at all hours of the day. In extremely



THE JACKAL ($\frac{1}{2}$ nat. size).

hot weather they appear to suffer much, and may be found either lying in the water, where they spend most of the day, or sneaking away therefrom, instead of being, as usual, hidden away in their holes. Their food comprises not only carrion and the flesh of such animals as they are able to kill, but also fruit, maize, and sugar-cane. In the towns and villages of India the jackals act as efficient scavengers. Occasionally they take to killing poultry and lambs or kids; and Jerdon states that weakly goats and sheep often become their prey, while wounded antelopes are tracked down and killed. Among vegetable foods, the chief favourite seems to be the so-called ber-fruit; but Prof. Ball reports that in certain districts jackals do enormous damage to the sugar plantations, biting ten or a dozen canes

In addition to the ordinary cry there is, however, as the same writer remarks, another very peculiar call, "only uttered by the jackal, it is believed, when a tiger or a leopard is in the neighbourhood, and certainly uttered upon such occasions. The cry is unmistakable; I have several times heard it: but the jackal that makes it carries us at once into the region of fable and folk-lore. The same story that has existed on the shores of the Mediterranean for two thousand years at least, that a jackal acts as scout for the lions, or 'lions' provider,' and is repaid by a share of the prey, is commonly believed with regard to the tiger in India; and it is this peculiar jackal, known as Pheal, Phion, or Phnew, in Northern India, the name being taken from the cry, and as Bhalu, or Kol-bhalu in Southern and Western India, that is said to invariably precede the tiger, and to make the call just noticed. Several observers have, however, remarked that the jackal which makes the cry follows the tiger and does not precede him; and Blyth has observed that a pariah dog, on sniffing a collection of caged tigers in Calcutta, set up a most extraordinary howl, probably similar to that of the Pheal."

Occasionally the skull of the jackal has a peculiar bony process growing from the upper part of the occiput, which is said to be covered during life by a horny sheath, concealed among the hair, forming the so-called "jackal's horn." The female jackal generally gives birth to her young in a hole in the ground, although they have been found in an old drain; the number of cubs in a litter being usually from three to five. The pariah dogs of India breed freely with the jackal. Fossil remains of the jackal occur in the Siwalik Hills of Northern India.

The Black-Backed Jackal. The black-backed jackal (*Canis mesomelas*), is a very distinct African species. The adults of both sexes are characterised by their bright coloration, the sides of the body being red, the limbs and the upper part of the tail reddish yellow: while the back of the body and the end of the tail are black. In some cases the line of division between the black of the back and the red of the sides is more distinct than in others, and the size of the black area is also subject to variation, although invariably widest over the shoulders. The

individual hairs of the body are ringed with black and white or red and white, so as to produce a speckled appearance in the fur. The under-parts of the body and the inner sides of the limbs are nearly white, the ears and part of the face being yellowish brown. This striking coloration occurs, however, only in the adult condition, the fur of the young being a uniform dusky brown. The dark band on the neck so often found in the common jackal is absent. The ears are very long.

The black-backed jackal was obtained by Mr. Blanford in Abyssinia, but not



BLACK-BACKED JACKAL ($\frac{1}{2}$ NAT.).

at such high elevations as the common species. The northerly limit of this jackal is Middle Nubia, from whence its range extends along the East Coast of Africa to the Cape, although there are many places in this tract of country where it is apparently absent. In South Africa it extends across the continent, and up the western side as far as Mossamedes, but it is unknown in the Congo district. This jackal occurs both in the open country and in bush jungle. In the sandy regions on the shores of the Red Sea it is to be found frequently in the small thickets covering the banks of the ravines, which swarm with hares and pangolins, upon which the jackal feeds. At night it visits the villages of the natives, and in Somaliland it is stated to bite off the fat tails of the sheep. In the Sudan it lives chiefly upon the smaller antelopes, mice, jerboas, and other Rodents. In South

Africa the fur of the black-backed jackal is much esteemed by the natives, and is used for making their cloaks or carosses.

Side-striped Jackal. The second species of South African jackal is the side-striped jackal (*Canis adustus*), so named from the oblique light-coloured stripe running along the flanks. This stripe is, however, very variable in its distinctness and degree of development, as may be seen by contrasting our two figures of this animal; and, in consequence of this difference, the species has been described under two specific names—the so-called *C. lateralis* being now proved to be identical with the earlier *C. adustus*, founded upon a specimen in which the



THE SIDE-STRIPED JACKAL. ($\frac{1}{2}$ nat. size).

stripe was but little apparent. The side-striped jackal differs from all the other species in the dark brown colour of the hair on the back of the ears; the ears themselves being relatively rather shorter than in the preceding species, although longer than in the common jackal. The snout is characterised by its length and slenderness. The general colour of the fur is yellowish brown, becoming paler on the under-parts. In examples which exhibit the feature from which the species takes its name, a light-coloured line runs on each side of the body from behind the shoulder-blade to a point near the root of the tail, a black line bordering the lower margin of this stripe. The greater portion of the tail is black, but its extremity is white.

This species has a wide distribution in Central and Southern Africa, having

been met with by Du Chaillu in the Gabun district, and by Mr. Johnston in the plains around Kilima-njaro on the east coast. Du Chaillu states that on the west coast these animals hunt in packs, surrounding and chasing such kinds of game as they are able to kill. He gives the native name of the animal on the west coast as Mboyo, but according to Dr. Pechuel-Loesche—who mentions that it is chiefly nocturnal, and seldom seen between the hours of nine and four in the day—it is known in the Loango district as the Mbulu. It preys upon the smaller mammals and sick individuals of the larger species, and will also eat the fruit of the oil-palm.



VARIETY OF THE SIDE-STRIPED JACKAL ($\frac{1}{4}$ NAT. SIZE).

In inhabited districts on the west coast the side-striped jackal frequently enters the native villages, where it interbreeds with the domestic dogs. Its cry, which may be heard night and morning at all seasons of the year, is fully as long-drawn and appalling as that of the common jackal. Pechuel-Loesche tells us that these animals can be tamed with facility, and that, when in the Loango district he had several young specimens, one of which attained maturity. They were extremely playful, and would run after and catch almost any animals they saw, including beetles, grasshoppers, birds, and small mammals. They would readily eat almost anything that was offered them, such as bread, beans, rice, fish, flesh, bananas, and oil-palm nuts. Although gentle and friendly as a rule, to some individuals they took a marked dislike, growling and showing their teeth when-

ever they approached. One of these tame jackals would answer to its name, "Mbulu," and was remarkable for the cleanliness of its habits, being particularly averse to getting its feet wetted by rain, seeking during showers the shelter of the huts. As a rule, it never sat down on its haunches after the manner of a dog, but would lie at full length, with its nose resting between its fore-paws, and would generally select a sunny spot, where it lay blinking in the sunlight.

THE DINGO (*Canis dingo*).

Were it not for the fact that Australia has so few native Mammals, which do not belong to the Marsupial group, the dingo would unhesitatingly have been regarded as an aboriginal inhabitant of the country where it is found; in which case it would rank as what we may call a natural species. The improbability of Australia possessing a native placental mammal of such large size as the dingo is, however, so great as to induce the belief that the animal was introduced by man, and hence that it originated from some of the dogs of Asia. This supposed introduction must, however, have taken place at so early a date that there has been considerable hesitation among some zoologists in admitting any such origin; and certainly the recent arguments in favour of its being an indigenous species have very great weight. Be, however, its origin what it may, there can be no doubt that the dingo is the only true dog now found in a wild state.

The dingo is an animal of smaller size than a wolf, with moderately tall legs, a long and somewhat bushy tail, a broad and short muzzle, and well-developed ears. In regard to colour, Prof. Mivart remarks that "the dingo varies in its coloration from red to black. There is a greyish under-fur, but, save in the black variety, the long hairs are generally yellow or whitish. The top of the head and dorsal region generally are of a darker reddish yellow, often intermixed with black. The under-parts are paler and may be whitish. The end of the tail is very often white, as are frequently the feet, and sometimes the muzzle, though this is also sometimes black. The animal may be of a uniformly light reddish or yellowish brown, save that it is paler beneath, on the outside of the fore-legs, below the elbow, as well as on the inner side of the limbs and on the cheeks."

The dingo is found in wooded districts throughout Australia, and in many such situations is extremely numerous; although the Government reward for its destruction has in other parts led to a considerable diminution in its numbers. It is a terrible foe to sheep, killing and mangling a far greater number than it eats; and it is equally destructive to poultry. On account of these depredations, the colonists wage a war of extermination against it, large numbers being poisoned with strychnine.

Habits.

In mode of life and habits Brehm compares the dingo to the fox rather than the wolf. It is shy and retiring, rarely seen during the daytime, and pursuing its work of devastation during the night. It is but seldom found in large numbers together, parties of from five to six individuals—generally consisting of a mother and her cubs—being the most common. Occasionally, however, troops of from eighty to one hundred individuals have been seen. Each family is stated to have a strictly defined area, beyond which

its members do not venture, and into which those of other families do not intrude. The young are generally born in the hollow trunk of a tree, and vary from six to eight in a litter. Naturally, dingoes never bark; although, like wolves, they easily learn to do so from association with other dogs. When caught they are generally in the habit of shamming death.

The dingo breeds freely with the various European dogs introduced by the colonists. In regard to their domestication by the Australian natives, Dr. Linnholtz states that on the Herbert river there are rarely more than one or two



THE DINGO ($\frac{1}{2}$ nat. size).

dingoes in each tribe, and as a rule they are of pure blood. The natives find them as puppies in the hollow trunks of trees, and rear them with greater care than they bestow on their children. The dingo is an important member of the family; it sleeps in the huts, and gets plenty to eat, not only of meat, but also of fruit. "Its master never strikes, but merely threatens it. He caresses it like a child, eats the fleas off it, and then kisses it on the snout. Though the dingo is treated so well it often runs away, especially in the pairing season, and at such times it never returns. Thus it never becomes perfectly domesticated, but still is very useful to the natives, for it has a keen scent, and traces every kind of game; it never barks, and hunts less wildly than our dogs, but very rapidly, frequently capturing the game on the run. Sometimes it refuses to go any further, and its owner has then to

carry it on his shoulders, a luxury of which it is very fond. The dingo will follow nobody else but its owner."

In writing on the origin of the dingo, Prof. McCoy observes that its fossil remains are found, in certain of the superficial and cavern deposits of Australia, in association with those of a number of extinct species more or less closely allied to the Marsupials still inhabiting the country. The introduction of the dingo—if introduced it really was—is thus carried back to the Pleistocene division of the Tertiary period; but we believe we are right in saying that in some at least of the deposits in which its remains occur there is also evidence of the contemporary presence of man. If, indeed, in all the deposits in which dingo bones occur there were also indications of human presence, the introduction of the animal by human agency would present no difficulty; but it does not appear that such is the case.

DOMESTIC DOGS (*Canis familiaris*).

Although many different views have been and still are entertained as to the mutual relationship and origin of the various breeds of domestic dogs, authorities are agreed that primitively the whole of them were derived either from wolves or jackals, or from both together. Whether, however, the origin has been a single one, that is to say, whether all domestic dogs were derived from one particular species of wolf or from a single species of jackal, or whether they are a product of the crossing of two or more distinct races, independently derived from as many wild stocks, is still an open question, and one indeed which is likely to remain undecided. Our own opinion inclines, however, towards the view of the multiple origin of the domestic dog; but even if its origin be single there can be little doubt that such an original domesticated breed has subsequently received extensive crossing with wild species other than the one from which it originally sprang.

That domestic dogs trace their origin to wolves or jackals, or both together, and not to foxes, is evident from the structure of their skulls; and that the domesticated races are not descended from the wild dogs of Asia, is evident from the latter having one molar tooth less in the lower jaw than is the case with the other members of the genus. Additional testimony that the foxes have nothing to do with the origin of the domestic dogs is afforded by Mr. Bartlett, who writes that he has never met with a well-authenticated instance of a hybrid between a fox and a dog, notwithstanding numerous specimens of supposed hybrids of this sort, which from time to time have been brought to his notice. Since this was written there has, however, been some evidence published in *Land and Water*, to the effect that these animals may occasionally cross.

The different breeds of domestic dogs present variations far greater, both as regards size and form, than those between any wild members of the canine family. Great as these differences undoubtedly are, they are to some extent paralleled among the various breeds of domestic pigeons and fowls, the former of which are definitely known to have originated from a single wild stock. But, since dogs of very different breeds freely cross with one another, and the resulting progeny is perfectly fertile, there can be no difficulty in regarding all the domesticated races as now constituting a single species. The fact that at the earliest historical



AN ESKIMO AND HIS DOGS.

period in which we have evidence of the existence of domesticated dogs, there were several distinct breeds, more or less closely resembling some of those still extant, has been urged as an important argument in favour of the multiple origin of the group; but too much weight must not be attached to this. The main argument in favour of the view of the multiple origin of the dog is that the different early and original breeds of the domestic dogs of different countries approximate in appearance to the wild species of the same regions. For instance, the Eskimo dogs are exceedingly like wolves, and Mr. Bartlett states confidently that we are justified in regarding them as nothing more than reclaimed wolves. Indeed, the Eskimo are said to be in the constant habit of crossing their dogs with wolves, in order to maintain their size and stamina. Then again some of the more northerly tribes of the Indians of North America have wolf-like dogs, their howls being so like those of wolves that even their owners can scarcely distinguish between the two. On the other hand, the domestic dogs of the Hare Indians closely resemble the coyote, which is the most common species in the districts inhabited by those tribes. These dogs are stated, indeed, by Sir J. Richardson to present precisely the same relation to the coyote as is borne by the Eskimo dog to the common wolf. Then again the black wolf-dog of Florida is almost indistinguishable from the black variety of the wolf characterising that country. Further, many of the sheep-dogs and wolf-dogs of Europe resemble the wolves inhabiting the same districts; and Blyth was struck with the marked resemblance of some of the pariah dogs of India to the wolf of the same country. Moreover, in South-Eastern Europe and Southern Asia many of the domestic dogs so closely resemble jackals, that it is sometimes difficult to distinguish between them. Still more important is the circumstance that some of the domestic dogs of South Africa present a striking resemblance in form and colour to the black-backed jackal of the same regions, although they have lost the distinct black back characteristic of the latter. Equally noteworthy is the resemblance observed between certain South American domestic dogs and the wild Azara's dog of the same regions. From this evidence Darwin was inclined to believe that domestic dogs were descended from the common wolf and the coyote, from the various local varieties of the former, from the Indian wolf, from Azara's dog and another South American species, from at least two species of jackals, and perhaps from one or more extinct species. "Although it is possible or even probable that domesticated dogs, introduced into any country and bred there for many generations, might acquire some of the characters proper to the aboriginal *Canide* of the country, we can hardly thus account for introduced dogs having given rise to two breeds in the same country, resembling two of its aboriginal species."

Mr. Bartlett, who is likewise a believer in the multiple origin of domestic dogs, observes that "the fashion of hunting led, in all probability, to the separation of domestic dogs into two well-known breeds, viz., those that hunt by sight, as distinguished from those that hunt by scent; for there can be no doubt that at a very early period dogs were used in the chase of wild animals. . . . The usefulness of dogs being established at a very early period would naturally lead to great care being bestowed upon them, and doubtless to the breeding of them in a domestic

That the dog was one of the earliest animals domesticated by man rests upon abundant evidence. Summing up the evidence on this point, Darwin observes that during the Roman classical period hounds, house-dogs, lap-dogs, and other breeds were already well established, although it is in most cases impossible with any certainty to recognise the greater number from their portraits. A fresco representing two greyhound puppies is, however, quite distinctive; and it appears that the ancient Romans were accustomed to class their different breeds into house-dogs, sheep-dogs, and sporting dogs, the latter being again subdivided into fighting dogs, hounds hunting by scent, and hounds hunting by sight (greyhounds). An Assyrian monument with an assigned date of about B.C. 640 shows the figure of a large mastiff; and Egyptian monuments, ranging from about B.C. 3400 to 2100, exhibit numerous figures of dogs, most of which approach the greyhound type. On one monument of the later of these two dates there is a dog resembling a hound, with drooping ears, but with a longer back and more pointed muzzle than those of modern hounds. There is also a short and crooked-legged dog with a long body, which Darwin compares to a turnspit, although thinking it improbable that this ancient race was the parent of the modern breed. The oldest dog represented on the Egyptian monuments is, however, one of the most peculiar, resembling a greyhound in general form, but with long pointed ears, and a short curled tail, a somewhat similar race of dogs still existing in Northern Africa. The ancient Egyptians had also a dog like the Indian pariah. "We thus see," observes Darwin, "that at a period between four and five thousand years ago, various breeds, viz., pariah dogs, greyhounds, common hounds, mastiffs, house-dogs, lap-dogs, and turnspits existed, more or less closely resembling our present breeds. But there is

not sufficient evidence that any of these ancient dogs belonged to the same identical subvarieties with our modern dogs." The record of the antiquity of domesticated dogs does not, however, stop with the Egyptian monuments, for there is evidence that several breeds existed during prehistoric periods, that is to say, during the iron, bronze, and polished-stone epochs. Thus, in Denmark, there was one race in the stone epoch, succeeded by a larger one in the bronze age, and by a still larger breed in the newer iron age. Again, during the polished-stone period in Switzerland, the inhabitants of that country had a medium-sized dog which appears to have possessed characters common to hounds and setters, or spaniels; its skull being markedly distinct from those of both the wolf and the jackal. In the bronze period this lake-dog was succeeded by a larger kind, probably very similar to the one we have already noticed as occurring in Denmark during the same period. Remains of the lake-dog, together with those of two other breeds, have been recognised from caverns on the Continent; and Wöldrigh comes to the conclusion that the lake-dog was not derived from either the wolf or the jackal but from some extinct species. If, then, we regard the lake-dog as in any way related to our modern breeds, and also admit its descent from an earlier extinct form, it will be apparent how hopeless is the task of attempting to solve the problem of the actual parentage of the dogs of the present day.

The number of varieties of domestic dogs was estimated by Fitzinger in 1876 at no less than one hundred and eighty-five, which were grouped in seven main divisions. Mr. Harting considers, however, that the main groups may be reduced to six, characterised to a certain extent by the form and size of their ears. These groups are—(1) wolf-like dogs, (2) greyhounds, (3) spaniels, (4) hounds, (5) mastiffs, and (6) terriers. By intercrossing between various members of these different groups he considers that all the existing breeds may have been produced. In the case of the more important breeds this grouping will be followed so far as practicable, although it is frequently difficult to decide under which heading to place many of the breeds produced by crossing members of different groups.

The most wolf-like of all the domestic breeds is the Eskimo dog, figured on p. 511. With their small upright ears, nearly straight bushy tails, moderately sharp muzzles, and rough coats, as well as in their general build, so closely indeed do these dogs resemble wolves that a pack of them has at least on one occasion been actually mistaken for such. These affinities are further indicated by this dog's inability to bark; and, as already mentioned, it may be considered as merely a domesticated wolf. The Eskimo dog is found throughout the greater part of the Arctic regions, and is absolutely essential to the existence of the inhabitants of those dreary countries, as without its aid they would be unable to make their migrations, or to transport the produce of their sealing and fishing expeditions to their homes. Although differing somewhat in colour, the Eskimo dogs of Arctic America, Siberia, and Kamtschatka, all resemble one another very closely, and the description of those of one district is equally applicable to those of another.

Many accounts of the habits and appearance of these animals have appeared, but since many of these have been quoted we shall confine ourselves to certain extracts from one of the most recent observers, Dr. Guillemard, who states that on

one occasion he had an opportunity of seeing more than two hundred collected together. "Most of them are white, with black heads, or entirely of a brown black; and their general aspect, owing to the sharp muzzle and prick ears, is decidedly wolf-like. The only food they are provided with by their masters is salmon of the hump-backed kind; but during the summer they pick up game, eggs, and birds in their wanderings about the country. They are usually harnessed in teams of eight or ten, but where the sledges are heavy or the roads bad, double that number, or even more are occasionally used. When the snow is hard and even, they will draw a weight of 360 lbs. a distance of five-and-thirty or forty miles with ease in a day's work; and with an unloaded sledge, with a single occupant, a pace of eight versts an hour can be kept up for a considerable time. On the road they are given one-third of a fish twice during the day, and a fish and a half at night, which they wash down with a few gulps of snow. . . . Each has a name, which he answers to when he is driven in the sledge, just in the same way as a Cape ox in a waggon team, for no whips are used. If chastisement be necessary, the driver throws his stick at the delinquent, or pounds the unfortunate creature with any stone that comes handy. There are many ways of tethering these animals, all having in view the one object of keeping them apart, as, excepting upon the road, they seize every opportunity of fighting. One method is by making a large tripod of poles, and tying a dog at the bottom of each; and in many villages, owing to the large number of dogs which have to be kept, these tripods form a characteristic feature."

In another passage Dr. Guillemard comments upon the hardships to which these animals have to submit. "No comfortable home is provided for him to enable him to withstand the rigours of the Arctic climate, and the poor beast, except when actually at work, has, in most cases, to 'find himself.' Long experience, and the instinct transmitted to him by his ancestors have, however, given him all the resources of an old campaigner. Stumbling at night about the uncertain paths of the settlements, the traveller is not unfrequently precipitated into the huge rabbit-burrows which the animal constructs to avoid the cutting winds. His coat, nearly as thick as that of a bear, is composed of fur rather than hair. . . . Wonderfully well-trained, cunning, and enduring, he is at the same time often obstinate and unmanageable to a degree, and is apparently indifferent to the kicks and blows so liberally showered upon him by his master. Excepting in settlements where neighbouring stretches of tundra render the use of sledges possible in summer, he has a long holiday during that season. During this time he wanders over the country at will, sometimes returning at night to his burrow, at others being absent for days together. A good hunter and fisherman, he supports himself upon the game and salmon he catches, and it is but rarely that he deserts his master for good. But the inhabitants have to pay a good price for his services. Owing to his rapacity it is impossible to keep sheep, goats, or any of the smaller domestic animals, and Kamschatka is one of the few countries in the world in which fowls are unknown."

**Hare Indian
Dog.**

As already mentioned, the Hare Indian dog presents the same relationship to the coyote as is borne by the Eskimo dog to the common wolf. This breed is found only in the region of the Great Bear Lake and

the Mackenzie River, and is used for hunting purposes by the Hare and some other Indian tribes. Richardson states that the "Hare Indian dog has a mild countenance, with at times an expression of demureness. It has a small head, slender muzzle, erect thickish ears, somewhat oblique eyes, rather slender legs, and a broad, hairy tail, which it usually carries curled over its right hip. It is covered with long hair, particularly about the shoulders; and at the roots of the hair, both on the body and tail, there is thick wool. The hair on the top of the head is long, and on the posterior part of the cheeks it is not only long, but, being directed backwards, it gives the animal, when the fur is in prime order, the appearance of having a ruff round



POMERANIAN DOG: ($\frac{1}{2}$ nat. size).

the neck. Its face, muzzle, belly, and legs, are of a pure white colour, and there is a white central line passing over the crown of the head and the occiput. The anterior surface of the ear is white, the posterior yellowish grey or fawn-colour. The end of the nose, the eyelashes, the roof of the mouth, and part of the gums are black. There is a dark patch over the eye. On the back and sides there are larger patches of dark blackish grey or lead colour, mixed with fawn-colour and white, not definite in form, but running into each other. The tail is bushy, white beneath and at the tip. The feet are covered with hairs, which almost conceal the claws." This dog, although of a playful and affectionate disposition, is not very docile, and is impatient of all kinds of restraint. Its general voice is very like

that of the coyote, but when it for the first time sees any new and startling object it attempts a kind of bark.

Pomeranian Dog. Under the title of Pomeranian dog are included a large and a small variety, of which the latter is represented in the figure on the preceding page. The Pomeranian may be regarded as the nearest ally of the Eskimo dog, and is a middle-sized or small animal, of strong build, with a sharply-pointed muzzle, upright and pointed ears, and a thick bushy tail generally carried curled over the back. The fur is long and coarse, and varies in colour from black through grey, yellowish, and foxy-red to pure white: the darker varieties usually have a lighter patch on the forehead, and also white marks on the feet. The larger Pomeranian was formerly used as a wolf-dog, and should properly be of a pale fawn-colour, without any admixture of white, and with black "points."

The smaller Pomeranian is a better-known animal, although it has the disadvantage of being somewhat uncertain in temper. The spitz, as this variety is often called, is employed as a sheep-dog in its native country, and is then most esteemed when entirely black. There is, however, on the Continent an almost complete transition from the pure black to the white spitz, which was the one most commonly met with in England, till the black breed came into fashion. A well-bred white spitz ought to have a black tip to the nose; and in all cases the ears should be perfectly upright, without any tendency to fall over at the tips. The heavily-furred curly tail is generally carried on the left side of the body. The fur on the throat forms a thick frill or ruff, and there is a considerable amount of long hair on the fore-legs. The face has only very short hair.

Closely resembling the spitz in appearance is the Chinese sheep-dog, the general colour of which is reddish, with a mixture of dark brown hairs in the fur of the back, which gives it a somewhat speckled look.

Sheep-Dog. The sheep-dog and its ally the Scotch collie depart more from the wolf-like type than the species hitherto noticed, in having the tips of the ears pendent. According to "Stonehenge," the old English sheep-dog has a sharp muzzle, medium-sized head, with small and piercing eyes: a well-shaped body, formed after the model of a strong low greyhound, but clothed in long and somewhat thick and woolly hair, which is particularly strong about the neck and bosom. The tail is naturally strong and bushy. In almost all sheep-dogs there is a double dew-claw on each hind-leg, and very often without any bony attachment. The legs and feet are strong and well-formed, and stand road-work well, and the untiring nature of the dog is very remarkable. The colour varies greatly, but most are grey, or black, or brown, with more or less white. Many of the sheep-dogs used in England have, however, been crossed with other breeds, and thus depart more or less widely from the original type.

The sheep-dog of France and Germany is very similar in general appearance to the English breed, showing the same indifference to caresses and the same attention to its particular business. Sheep-dogs commence their training during their first year, and learn their work with wonderful rapidity. On the Continent they are employed not only in tending sheep, but likewise goats and cattle: but in England the variety known as the drover's dog is more generally used for cattle herding.

Collie. A handsomer animal than the English sheep-dog is the Scotch collie, which has the same mental characters, but differs somewhat in external form and coloration. This dog has the same sharp muzzle as its English cousin, but a rather broader head, with a slight fall to the tips of the small ears. The build of the body is rather light and elegant; and the hair with which it is clothed is long and woolly, and stands out evenly on all sides so as to form an efficient protection from the extremes of climate to which the animal is exposed in its native hills. The ruff on the neck is more developed than in the sheep-dog, and indeed than in any other breed. The tail is very bushy, and is carried with the tip elevated, so as to keep its long hairs free from the ground. In



ROUGH-COATED COLLIE.

the pure-bred animal there is a thick under-fur beneath the long hairs, and the hind-legs should be quite free from any fringe of hair, although the fore-legs may have a little fringe. The colour may be either black-and-tan, or either of these tints alone, with a larger or smaller admixture of white; but the black-and-tan appears to be the most admired. The black is seldom very intense in tone, and the tan has no tinge of the mahogany-red of the setter. The collie has been introduced into England as a pet dog, and is often crossed with the black-and-tan setter, so as to produce a breed which differs considerably from the original form—notably in the silky hair, without under-fur, and the long fringes on both fore and hind-legs. In some parts of the Scottish Highlands, and likewise in the north of England, there is a smaller and more slender variety known as the smooth collie. This breed is characterised by the smooth coat of short and stiff hairs, which

are generally of a mottled-grey colour, more or less mixed with white, but may be black-and-tan, or even tan-and-white.

All the breeds of sheep-dogs display their affinity to the wolf in their elongated and narrow skulls, with very long muzzles, and the profile of the face only displaying a slight degree of concavity. The premolar teeth are separated from one another by distinct intervals: and there is no tendency for the lower incisor teeth to project beyond the line of those of the upper jaw.

Drover's Dog. The drover's dog varies considerably in different districts of England, and is generally a cross between the sheep-dog and some other breed. The size of these dogs is likewise very variable; and both this and the general form appear to be modified by breeders according to the special needs of the districts for which the animals are required. Drovers' dogs generally have their tails cut short. Their especial duty is to conduct flocks and herds from one locality to another, and they are remarkably adept in separating the members of the herd under their own charge from those of any other herd which they may meet during their journey.

Pariah Dogs. A brief allusion may be made here to those nondescript dogs found in troops in the towns and villages of Eastern Europe, Asia, and Africa, and commonly designated pariah dogs. These animals vary greatly in different districts, but many present a very wolfish appearance, and it is probable that they often interbreed with the wolves and jackals of their respective countries, while in India they may perhaps also cross with wild dogs. Originally, however, these pariah dogs were undoubtedly domesticated breeds, which, from neglect, have reverted to a greater or lesser extent towards a wild state. The pariah dogs of Egypt appear to belong to a single race, and are of about the size of a sheep-dog, but of a stouter build, with a broader head: the tail being long and generally bushy, and carried close to the ground. The general colour of their coarse rough hair is reddish brown, tending in some individuals more decidedly to grey, and in others to yellow. Occasionally black or tawny individuals may be observed. Their ears are short, pointed, and usually erect. They live a perfectly independent life, generally frequenting the rubbish-mounds with which the old Egyptian towns and villages are surrounded, and passing the greater part of the day in sleep, while towards evening they wake up and prepare themselves for their nocturnal peregrinations. Each dog possesses its own particular lair, which is chosen with especial care: and frequently one dog will have two such lairs, one of which is occupied in the morning, and the other in the afternoon. When, as is often the case, the mounds in the neighbourhood of Cairo run nearly north and south, so that both sides are equally exposed in winter to the cold north wind, the dogs are careful to excavate a hole facing the south, in which they may gain protection from the cutting blasts. In the morning the dogs will be found lying in these lairs, which have an easterly aspect, so that they may receive the full benefit of the sun's rays: towards ten or eleven o'clock, however, these quarters become too hot to be pleasant, and they then shift to the west side of the mound, or to some other shady spot where they may continue their sleep. When the sun reaches their lairs on the western side of the mounds the dogs once more return to their morning haunts, where they remain till sunset.

Pariah dogs in other countries are very similar in manners to the above, but in Constantinople and most Indian cities they habitually frequent the streets, and are as habitually ill-used by the passers-by. In Siam and some other Buddhist countries they are, however, specially protected by the lamas, or priests, and are allowed to use the temples as places of refuge: but the food supply of these dogs is of the scantiest, and their appearance is consequently miserable in the extreme.

English Greyhound. With this breed we come to the first member of the second main group of dogs, all of which are characterised by their long and narrow muzzles, their slight build, elongated limbs, and small ears, falling at the



ENGLISH GREYHOUND ($\frac{1}{16}$ nat. size).

tips; but they differ greatly in the length of the hair. They are further characterised by their habit of hunting either entirely or partially by sight, instead of by scent.

The long slender skull of the greyhound points to close affinity with the wolf, and this group of dogs is, therefore, placed here. The English greyhound, which is of great antiquity, has indeed been regarded by some as the ancestral stock of all our domestic breeds of dogs, but this is more than doubtful. It may be so readily distinguished at a glance from all other dogs by its general slender form, smooth hair, and rat-like tail, coupled with its comparatively large

At one period the greyhound became too weak in the jaws to kill its prey, but this defect was remedied by crossing with the bull-dog, the bull-dog blood being gradually eliminated until the proper combination of strength with speed was attained. The head of the present breed should be broad and flat between the ears, without that arching characteristic of other breeds of dogs. The eyes should be of the same colour as the coat; and the ears always now fall at the tips, although there was an old-fashioned breed in which they were erect. The length of the neck should be approximately equal to that of the head; although it is not very easy to say in a living animal where the neck ends and the chest begins. Much importance is attached by breeders to the formation of the fore-quarters of the greyhound, the best strains having the shoulder-blades of great length, obliquely placed, and well clothed with muscle, and likewise the upper arm (humerus) of considerable relative length. Of not less importance is the conformation of the hind-limbs, in which the upper and lower leg should be of great relative length, so that the whole limb should be much bent at the junction of these two segments.

Then, again, the hind-limbs must be set rather wide apart at their lower extremities, to allow of their being brought forward with the utmost celerity in running; while in the haunches the attention of the breeder is especially directed to the development of sufficient width. That the foot-pads should be hard and horny, to withstand the wear and tear of racing over hard and rough ground, is self-evident, but there is some difference of opinion as to the precise form of foot which is most desirable. The tail should be entirely devoid of any fringe of long hairs, and, while thick at the root, should at first taper somewhat rapidly, and afterwards more gradually. It should hang close to the hind-quarters for the greater part of its length, terminating in an upwardly-inclined curve, which generally forms about three-fourths of a circle. Colour is regarded as of but minor importance in determining the "points" of a greyhound. A uniform coloration, such as sandy or slaty grey, is, however, generally preferred to a mixture.

Italian Grey-hound. This is kept purely as a pet, and may be regarded as a miniature of the English greyhound. Its proportions are most elegant, and its speed considerable; but so delicately is it made that it is incapable of pulling down even a rabbit. The muzzle and tail are relatively somewhat shorter than in the English greyhound: while the eyes are proportionately larger and softer. There are several colours, among which a golden fawn is the most valued: next to this comes a dove-coloured fawn, after which come cream-colour and the so-called

blue-fawn. There are also black, red, yellow, white, and parti-coloured varieties, several of which depend for their value upon the colour of the muzzle. In the uniformly-coloured varieties there should not be a single spot of white.



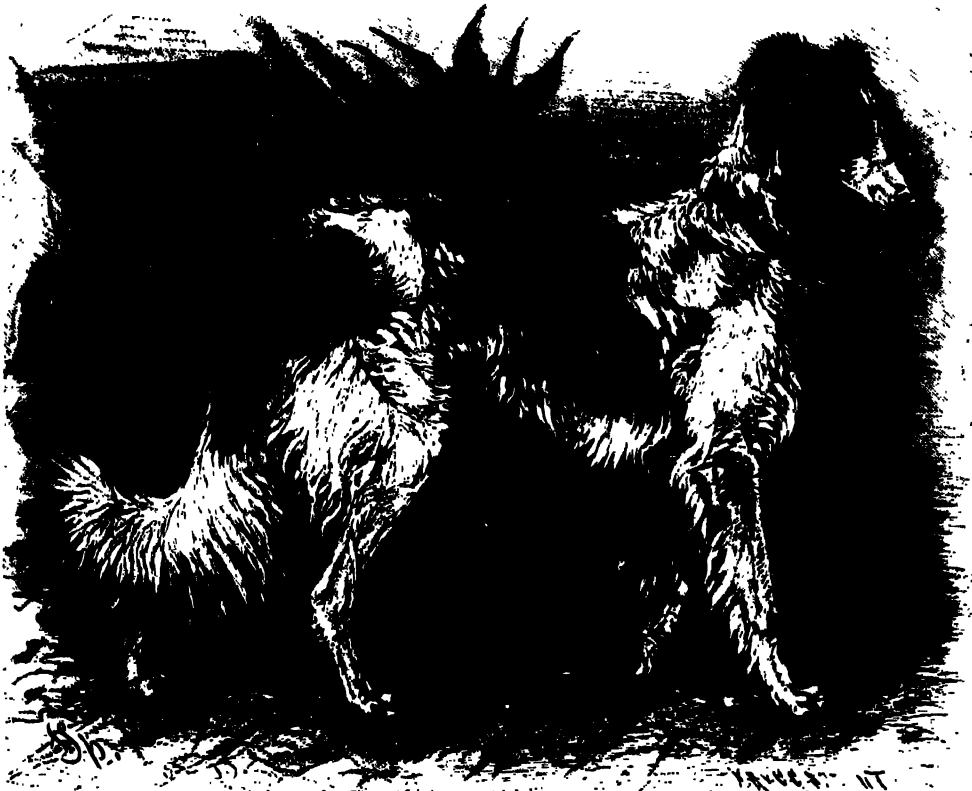
ITALIAN GREYHOUNDS ($\frac{1}{2}$ nat. size).

Deerhound. The Scotch deerhound, or rough greyhound, is larger and heavier than the English greyhound, frequently standing as much as 28 inches at the shoulder, while its weight may exceed 80 lbs., whereas that of the English greyhound is seldom above 65 lbs. The body is clothed with a rough and rather shaggy coat of hair, the texture of which varies in different breeds, being sometimes as stiff as in the wire-haired terriers, while in other cases it is of a more silky and woolly nature. The legs should be devoid of a fringe of hair; while the tail should likewise be comparatively smooth. The favourite colours in the Scotch deerhound are dark slaty grey, fawn, grizzled, or brindled. White should be absent, although a small spot on the forehead is not objected to. When the fawn-coloured variety has the ears tipped with brown it is considered perfect. The Scotch deerhound used to be employed both for deer-stalking and for coursing; and this different use has given rise to various strains of the breed.

Irish Wolf-Dogs. The ancient wolf-dogs of Ireland formerly enjoyed a reputation for great power and strength and their prowess against wolves. The original breed, or rather breeds, appear, however, to have completely died out, and we are thus acquainted with these animals mainly by tradition and history, although attempts have been made to reproduce them. It appears that there

were formerly in Ireland two races of wolf-dogs, one of which was a greyhound and the other a mastiff, somewhat resembling the great Dane; and it is shown from an old figure that there was also a cross breed between the greyhound and the mastiff-like dog, in which, however, the characteristics of the latter predominated. Skulls of these dogs have been discovered in various parts of Ireland, which indicate animals of great size and power. Some of these, belonging to the mastiff-like breed, are considerably larger than the skull of a German boarhound, which stood $32\frac{1}{2}$ inches at the shoulder.

Other Grey- In Eastern Europe and Western Asia there are several well-
hounds. marked breeds of long-haired greyhounds or deerhounds differing more or less markedly from one another, of which the Grecian, Persian, and



PERSIAN GREYHOUND ($\frac{1}{2}$ nat.)

Russian are the best known. The Grecian greyhound, which is used for coursing hares and can run either by scent or by sight, differs from the English greyhound by its completely pendent ears, the moderately long and silky hair clothing the body and the thickly-haired setter-like tail. The Albanian greyhound is a somewhat heavily-built animal, with finer hair on the body and longer and coarser hair on the tail. The Persians have long been celebrated for the excellence of their greyhounds, which, although less fleet than the English breed, are used in relays for

coursing gazelles, in which they are aided by falcons. They are likewise employed in hunting the wild ass. The Persian greyhound differs from the Grecian in having the ears fringed with long hair, in its more hairy nose, and also in the greater development of the fringe of hair on the tail. The hair on the body is, however, intermediate in length between that of the Grecian and English breeds. The colour may be either uniform, or, as in our illustration, a mixture of dark and light. The Russian greyhound is powerfully-built, and of rather larger size than his English cousin, being covered with a coarse woolly coat, and having fringed ears and fore-legs, and a very thickly-haired tail. It is comparatively slow in pace, and hunts the wolves against which it is employed both by sight and scent.

Hairless Dogs. Here may be mentioned the hairless dogs of Central Africa, which closely resemble greyhounds in general appearance. These dogs have long slender bodies, moderately elongated and thin necks, narrow and pointed muzzles, tall foreheads, long tails and limbs, and no dew-claws on the hind-feet. Their ears are pendent at the tips; and, like the body, are quite devoid of hair. Indeed, it is only in the neighbourhood of the tail, around the mouth, and on the limbs, that there is any hair at all. They are employed in Africa for hunting antelopes, and possess great speed: but their hairless skin renders them unsuited to live in any but the warmest climates. Other breeds of hairless dogs occur in China, Central and South America, Manilla, and the Antilles and Bahamas.

Lurchers. The lurcher is a cross either between the rough Scotch greyhound and the collie, or between the English greyhound and the sheep-dog, or any pair of these four. Some lurchers are very handsome animals, while others are equally ugly. With these variations it is difficult to give any precise description of the breed, which may, however, be roughly designated as a dog with the general shape of a greyhound, combined with the stouter build, larger ears, and rougher coat of the sheep-dog.

Field-Spaniels. With the field-spaniel, of which there are several varieties, we reach the third division of domestic dogs, all of which are characterised by their large pendent ears, comparatively wide heads, with moderate muzzles, relatively short and stout limbs, thick and frequently long hair, and thickly-haired tails. Their skulls are distinguished from those of all the dogs yet mentioned by their width and comparative shortness, this being especially noticeable in the palate and lower jaw. The profile of the skull is also more markedly concave, the brain case rising suddenly at the eyes, and thus indicating great mental power. True spaniels, as their name denotes, are probably of Spanish origin, and are divided into field and water-spaniels, in addition to which there are the smaller breeds kept only as pets. Field-spaniels form some of the best shooting dogs, and generally give notice of the proximity of game by their voice. They are now divided into the Clumber, Sussex, Norfolk, and Cocker breeds.

The Clumber spaniel is distinguished by its silence when hunting; and is a heavily-built animal, of comparatively large size, and soon tiring when at work. The head is massive, with a deep furrow along the top, large flesh or liver-coloured nostrils, large and generally hazel eyes, and long ears shaped like a vine-leaf, without a very long fringe of hair. In build the Clumber is long and low; the length of the head and body being properly two and a half times the height. The



CLUMBER SPANIEL.

wavy coat of a golden-liver colour, without any admixture of white. The Norfolk spaniel is subject to considerable variation, and is either liver-and-white, or black-and-white in its colour. It differs from the two preceding races by the lesser proportionate length of the body, and the longer fringe of hair on the

ears, which frequently nearly touch the ground. Cockers are small spaniels, and are now divided into Welsh and modern Cockers; the former being liver, or liver-and-white, while the latter are larger and generally completely black. The head is relatively long, the eyes are less full than in the other breeds; and the coat is soft, silky, and waved, with a considerable amount of fringe on the throat and limbs.

The King Charles and Blenheim spaniels are much smaller animals, probably derived from the Cocker. The King Charles is black-and-tan in colour, with a larger or smaller admixture of white, and is characterised by the great length of the ears. In both the muzzle is extremely short, with an upturned nose, while the head is nearly globular, and the ears should touch the ground. The coat should be long, silky, and wavy, but devoid of curl; while the ears, limbs, and feet should be abundantly fringed.

Irish Water-Spaniel.

The water-spaniels, of which the best-marked breed is the Irish, are relatively large dogs, with broad splay feet, and a woolly, thickly-matted, and often curly coat, which is more or less oily. The southern Irish water-spaniel is characterised by the bare face and thinly-haired tail, the presence of a distinct "top-knot" on the crown of the head, the long curls round the legs, and the thickly-curling coat of the body and ears; the colour being of a uniform puce liver tint. The northern variety of the Irish water-spaniel has shorter ears, with but little fringe, while the curls of the body hair are shorter and closer; the colour being either liver or liver-and-white.

Setters.

The various breeds known as setters are large spaniels which have acquired the habit of pointing at their game. They derive their name from having been originally taught to crouch down when marking game, in order to admit of the net with which the quarry was taken being readily drawn over them. With the use of guns this habit became, however, of no advantage, and setters were taught to assume the attitude of pointers. At the present day there are five chief breeds of setters, three of which are commonly seen in England.

The English setter, which is regarded as the result of a cross between the field-spaniel and the pointer, should have a silky coat, with a slight wave, but no curl



IRISH SETTER ($\frac{1}{4}$ nat. size).

in the hair. The fore and hind-legs should be thinly fringed with hair, while in the tail the fringe of long hair should fall regularly like the teeth of a comb, without any signs of bushiness. In the middle of the tail the length of the fringe should be from 6 to 7 inches in length, while at the point it should not exceed half an inch. An abundance of hair between the toes is another "point" of the setter. There is great variation in colour, which is valued according to the following scale, viz. black-and-white ticked with large splashes, known as the "blue Belton"; orange-and-white freckled, known as "orange Belton"; orange or lemon-and-white without ticks; liver-and-white ticked; black-and-white with slight tan markings; black-and-white; liver-and-white without ticks; pure white; black; liver; red or yellow. The Irish setter is generally of a red colour without

any trace of black, and little or no white; but there is one strain characterised by its red and white coloration. It is a rather more "leggy" animal than its English cousin, with a narrower and rather longer head, more produced nose (of which the colour is generally deep mahogany), and more tapering ears, which, when extended, should reach nearly to the nose.

The *Gordon*, or *black-and-tan setter*, is now characterised by its mixture of jet-black and mahogany-tan colours, although the original breed was black, tan, and white. It is a heavier animal than either the English or Irish breeds, this heaviness being specially shown in the head, which makes some approach to that of the bloodhound. The nose is relatively wide, and rarely shows the concave profile of the English setter; the tail is rather short; while the coat, although in some strains silky, may be much coarser than in the other breeds. The Welsh setter, which shows a great amount of variation in colour, is distinguished from the preceding by its curly coat. Finally, the Russian setter, according to "Stonehenge," "is almost entirely concealed by a long woolly coat, which is matted together in the most extraordinary manner, and which would lead to the supposition that he would be unable to stand heat as well as our early setters; but, on the contrary, he bears it almost like a pointer."

Retrievers.

This name is applied to large dogs employed for retrieving game on land, in contradistinction to the water-spaniels which are used for the same purpose in water. These dogs have more or less Newfoundland blood in them, and trace their other parentage to the water-spaniel or setter. The curly-coated retriever, which may be either black or tan, is the product of a cross between the smaller black Newfoundland and the water-spaniel. It is characterised by the short hair of the face, and the tail devoid of any fringe, although covered to within a few inches of its extremity with short crisp curls. The hair on the body is closely and crisply curled. The wavy-coated retriever may be either a pure-bred small black Newfoundland, or a cross between it and the setter.

Newfoundland.

The Newfoundland dog, of which there are three distinct breeds, is regarded as nothing more than a large spaniel, and its general form and the facility with which it may be crossed with spaniels and setters seem to fully bear out this view. The especial characteristic of the Newfoundland is its well-known fearlessness of water, and the readiness with which it will risk its own life to rescue human beings from drowning. The true Newfoundland, as represented in our illustration, is the largest breed, and should stand from 25 to 30 or 31 inches in height at the shoulder. The coat should be shaggy and somewhat oily, and the tail long and bushy and slightly curled on one side: the colour black, with or without some admixture of white: the specimens with the least white being the most admired. Sometimes the black has a rusty tinge. The head in the best-bred animals is large and broad, and nearly flat on the top, with a well-marked ridge at the eyes: while the expression of the countenance conveys a look of grandeur and intelligence without fierceness. The muzzle is relatively wide, and clothed with short hair: while the skin on the forehead should show some slight wrinkles. Both the ears and eyes are relatively small: the former being covered with short hairs, which become slightly longer at the edges: while the latter should be brown in colour and mild in expression. The neck has no distinct frill: while

the fore-legs should be fringed above, but nearly smooth below. The feet, although necessarily large, should be compact so as not to spread out under the weight of the body. The Landseer Newfoundland, said to be unknown in the island from which these dogs take their name, differs from the preceding in its looser build, less noble appearance, more woolly coat, and by the ground-colour being white, upon which are black spots. The smaller black Newfoundland, also known as the St. John's Newfoundland, or Labrador dog, is inferior in size to the Newfoundland, standing not more than 22 or 23 inches in height, and having a relatively smaller

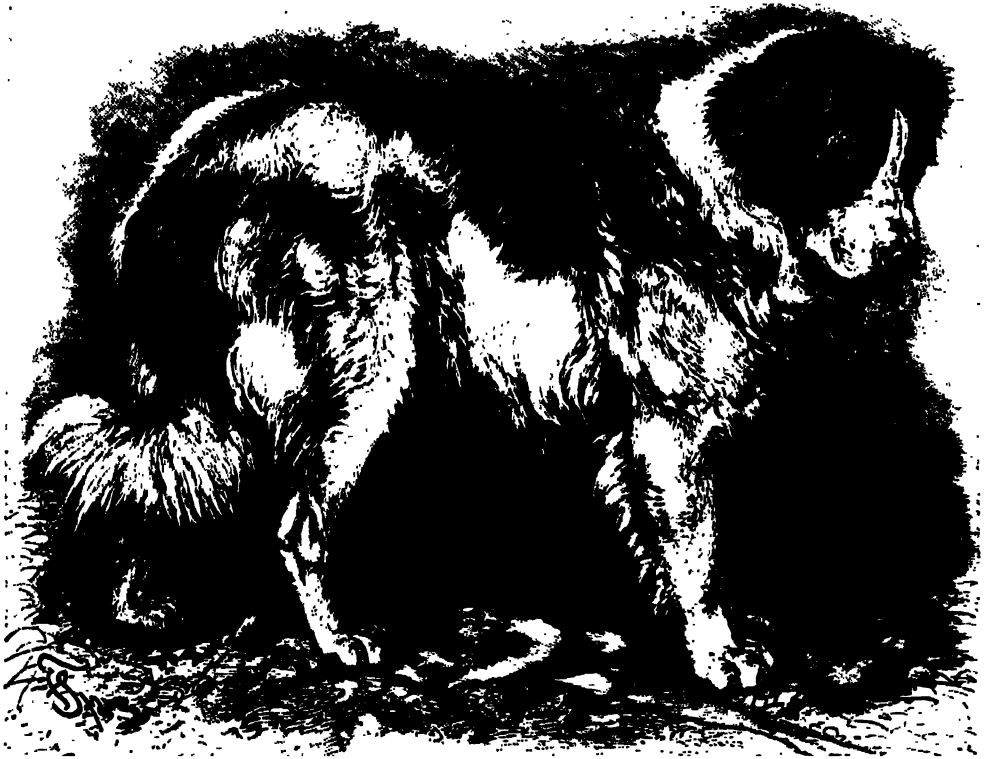


NEWFOUNDLAND DOG ($\frac{1}{2}$ NAT. SIZE).

and less massive head. Its coat is moderately short and wavy, without any under-fur, and should be entirely black, although there may be a white spot on the forehead or a white toe. The fore-legs are fringed with long hair down to the feet.

St. Bernards. The magnificent dogs, taking their name from the monastery of Mount St. Bernard, and formerly unknown beyond the Alps and adjacent regions, are remarkable for their high intelligence, and are used in the Alps for rescuing travellers lost in the snow. In size they attain dimensions only equalled by those of the great Dane, and are larger than any wild member of the family. A very large St. Bernard, known as "Young Plinlimmon," measures upwards of 68 $\frac{1}{2}$ inches from the tip of the nose to the root of the tail; while others are known which measured respectively 64, 63, and 60 inches. These dogs are

divided into rough and smooth St. Bernards, according to the length of the hair; our illustration representing a specimen of the rough-haired breed. The rough St. Bernard has the coat of the body long and wavy, with the tail very bushy, and the fringe on the fore-legs comparatively small. There is great variety in colour; one strain being a rich orange-tawny mixed with brown, others are red-and-white, others, again, brindled or fawn, or those colours more or less mixed with white, while some may be almost white. The head is large, with a higher elevation at the eyes than in the Newfoundland, and the muzzle rather long and squared, with



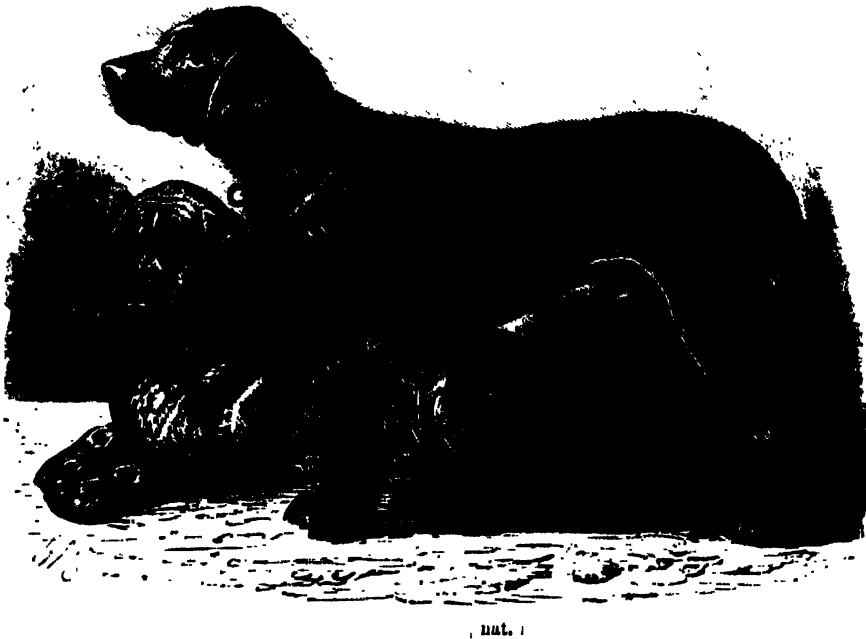
ROUGH ST. BERNARD

slightly pendulous lips. The ears are relatively small, and their hair should be rather rougher than that of the body. The eyes are full but deeply set. The feet are very large, apparently for the purpose of supporting the animal in the snows of its native home, and may be furnished with double dew-claws. The smooth St. Bernard differs mainly from the rough breed by its nearly smooth coat: the tail being comparatively thin, and the legs and ears entirely free from any fringes of hair.

Bloodhound. The bloodhound is our first representative of the fourth division of domestic dogs, which includes the pointer, and all those usually denominated hounds. All are characterised by their large drooping ears; and most of them by their smooth coats, and the absence of any fringe of hair on

the ears and legs; while the tail is mostly but thinly fringed. The profile of the face is but slightly concave, and the muzzle relatively long and deep, with a more or less marked overlapping of the upper lip. With the exception of the pointer, they hunt by "foot-scent."

The most striking and characteristic feature of the bloodhound is its magnificent head, which is considerably larger and heavier in the male than in the female. While generally extremely massive, the head is remarkable for its narrowness between the ears, where it rises into a dome-like prominence, terminating in a marked protuberance in the occipital region. The skin of the forehead, like that round the eyes, is thrown into a series of transverse puckers, as is well shown in the recumbent figure of our illustration. The long and tapering jaws are



of great depth but relatively narrow, and abruptly truncated in front; while the upper lips are pendulous. The large and thin ears should hang close to the cheeks; and the small and deeply-sunk hazel eyes are characterised by the exposure of a considerable part of the membrane of the socket, which is generally red, and is technically known as the *haw*. The throat is heavy, and passes downwards into a more or less well-marked dew-lap. In the English breed the tail is slightly fringed with hair, although in our figured example it is quite smooth; it should be carried in a curve, but not raised above a right angle with the line of the back. The short coat should be coarse and hard on the back and sides, but soft and silky on the head and ears. The most esteemed coloration is black-and-tan, but the animal may be all tan; the presence of white being a blemish. Our illustration is taken from a foreign strain of the bloodhound, which is lower on its legs than the English breed.

Staghound. English hounds are descended from two extinct breeds, respectively known as the southern hound and the northern hound. Both of these were large heavily-built animals, with thick throats, distinct dew-laps, and large pendent ears resembling those of the bloodhound. They were slow in pace, and dwelt upon the scent more than their modern descendants. The true English staghound was a considerably larger animal than the foxhound, with a relatively broader and shorter head, and a more thickly-fringed tail, and was also distinguished by several points in the conformation of the limbs. The large foxhounds now used



STAGHOUNDS AFTER A CHASE ($\frac{1}{16}$ nat. size).

for stag-hunting in England stand about 25 inches high in the males, and from 23 to 23½ inches in the females.

Foxhound. The modern foxhound, derived from either the old southern or northern hound, with perhaps some cross of a different breed, is remarkable for the combination of speed and endurance which it possesses, and is thus an excellent instance of the results which can be attained by breeding with a particular end in view. The appearance of the foxhound is much modified by the artificial rounding of the ears—a process in which a large portion of the extremity of the lobe is cut away in order to prevent its becoming entangled in bushes. The coat should be short and hard, but at the same time glossy: the tail having a

distinct fringe of hair on its under surface. The favourite, or true hound colour, is black, white, and tan; but there are also several "pies" in which the respective colours are blended with white; while whole colours, or black-and-tan only, are not unknown. The endurance and speed of the modern foxhound is fully attested in numerous works on sport, and will not, therefore, be further mentioned here. "Stonehenge" observes that a peculiar "faculty in which the hound differs from his congeners is a mental one, leading him always, when he loses scent of his quarry, to cast forward rather than backward, and to do this with a "dash"



FOXHOUNDS IN FULL CRY ($\frac{1}{2}$ nat. size).

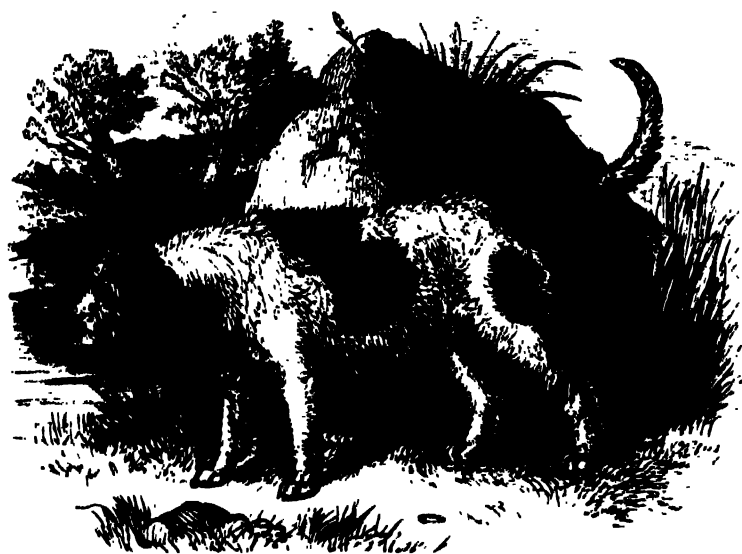
altogether unlike the slow and careful quest of the bloodhound. This, of course, may be overdone, and in that case the hound constantly overruns the scent; but without it in these days few foxes would be killed, for unless they are hard pressed the scent soon fails and is altogether lost." For ordinary country the male foxhound, such as shown on p. 576, should average 24 inches, and the female 22 $\frac{1}{2}$ inches in height: but in hilly districts smaller hounds are preferred.

Harrier.

This is a breed of hound trained to hunt hares instead of foxes, and intermediate in point of size between the foxhound and beagle. Pure-bred harriers, probably descended from the old Southern hound, are to be met with in Wales, but many of those used in England are crossed with the foxhound,

while in some cases a small breed of foxhounds is employed in hare-hunting. Owing to the absence of the practice of "cropping," harriers may be distinguished from foxhounds by their larger and pointed ears; and they generally have longer and narrower heads, with a deeper hollow under the somewhat fuller eye. The height generally varies from 16 to a little below 20 inches. The colours and general points are the same as those of foxhounds. A rough breed of Welsh harriers is practically indistinguishable from the otterhound. Harriers work more slowly than foxhounds, dwelling more on the scent and tending to cast backwards rather than forwards when they come to a check.

Otterhound. This breed so closely resembles a large rough Welsh harrier that it requires an expert to distinguish between the two; such difference as there is existing in the nature of the coat and the form of the feet. Thus the



THE OTTERHOUND.

feet, instead of having the neat cat-like form of those of the harriers, are broad and splay; while the coat is furnished with a thick woolly under-fur of an oily nature. Probably owing to having to contend with such a fierce animal as the otter, the otterhound is of a savage and quarrelsome disposition, and is very

apt to engage in internecine conflicts with its fellow-occupants of the kennel. Otter-hunting is a favourite sport in the West of England, Devonshire alone possessing four packs, one of which in the summer of 1892 killed three otters in a single morning. In some cases foxhounds are employed for otter-hunting.

Beagle.

This term is generally applied to any hound standing less than 16 inches in height, although the true pure-bred beagle is a distinct breed, which may be regarded as a miniature of the old southern hound. In build the ordinary beagle is rather short in the limbs and long in the body, with a relatively wide and somewhat dome-shaped head and a short nose. The throat is likewise rather short and thick, and the older breeds used to have a tendency to a dew-lap. The ears are full and hang in folds. Beagles may vary in height from about 15 to 10 or 9 inches; but from 11 to 12 inches is esteemed the best. They are used in hunting both hares and rabbits. The beagle has a remarkably musical note and an exquisite sense of scent, as well as great perseverance in following a

trail. From its small size, short legs, and rather heavy build, it is, however, necessarily slow. In hunting, beagles follow all the windings of the hare, and for the first part of the chase are far behind their quarry. Their perseverance is,



THE BEAGLE ($\frac{1}{2}$ nat. size).

however, generally successful in the end; and there is no prettier sight for the lovers of sport than to watch a well-trained pack of beagles at work.

Turnspit.

With the cessation of its monotonous occupation has been brought to pass the practical extinction of the old English turnspit. These dogs were long-bodied, short-limbed animals, with the fore-feet everted, and were closely allied to the dachshund; but differed in being relatively taller, with a longer head, longer nose, straighter forehead, less bent fore-limbs, and a longer and thinner tail; the ears being small and placed relatively far back. In colour, the turnspit was generally black-and-tan. These dogs performed their task in a kind of wire barrel, somewhat like that in a squirrel-cage; and in England two of them were generally kept, which worked turn-and-turn.

Dachshund.

Under the title of dachshund, or badger-dog, the Germans include two distinct strains of long-bodied dogs with short and crooked legs, one of which presents these characters in a less marked degree than the other, and has also relatively larger ears. The breed figured in our illustration has a long cylinder-like body, supported on short and bent legs, the head and muzzle large, the drooping ears also large, the paws of great size and furnished with sharp claws, and the coat short and smooth. The fore-feet are markedly turned outwards, and the hind-feet have large dew-claws; while the tail is thick at the root, from which it rapidly tapers to the end, without any fringe. The colour varies, but is generally black-and-tan, although not unfrequently either tan or yellowish, and sometimes

grey or parti-coloured. The second variety has a still longer body, and shorter and more bent legs than the preceding form, from which it is likewise distinguished by its smaller ears and shorter tail. The ear is set further back than in any other dog, its front border being scarcely in advance of the line of junction of the head with the neck. The tail should be carried over the back, and the smooth and glossy coat hard and wiry, except on the ears, where it becomes silky. Black-and-tan are the favourite colours in this breed; but whole tan, with a black nose, occupies the second place in the estimation of fanciers.

Dachshunds are used in their native country chiefly for hunting badgers, which are numerous in some districts. The strain with the longest body and the shortest legs is employed for digging the badgers out of their holes, while the other is used in the chase. From their small size and short limbs dachshunds are, of course, extremely slow, but they have a keen scent, coupled with great perseverance



THE DACHSHUND ($\frac{1}{4}$ nat. size).

and endurance, and therefore make admirable hounds. From its somewhat squeaky voice the dachshund has been regarded as more nearly related to the terriers than the hounds, but there is no doubt that its place is among the latter. In addition to badger-hunting, dachshunds are also employed in Germany in fox-hunting, as well as in driving game, more especially roe-deer, which require to be driven with great care and quietness in order to prevent them breaking back through the line of beaters.

Pointer.

That the various breeds of pointers are descended from the hound was first clearly indicated by Youatt. The disposition to "point" appears to be due to the results of training; and although other dogs have been taught to point, in no case do they assume the rigid condition so especially characteristic of the pointer. Indeed, in some of the old Spanish and French pointers, so intensely was this characteristic developed that the animals assumed a kind of cataleptic condition; and "Stonehenge" mentions that he has known some of them remain on the "point" for hours, until absolutely exhausted. Moreover, such dogs would frequently make "points" at imaginary game.

The pointer differs from the hounds in hunting by "body-scent" instead of by "foot-scent." The most ancient breed appears to have been the old Spanish pointer, which stood relatively high on the legs, and had a heavy clumsy head, with a long, wide, and squared nose, pendulous upper lips, with ears nearly as large as those of the bloodhound, and a massive throat and distinct dewlap. This pointer was of a surly disposition, slow in pace, and apt to give chase to hares. His redeeming point was, however, his marvellous perception of scent, and the perseverance with which he would work his game. The Portuguese pointer is of rather shorter build, with badly-formed legs and feet, and a long and fully-fringed tail, and displays the same faults of character as the Spanish breed. The French pointer is distinguished by the presence of a furrow between the nostrils, which renders its sense of smell less acute. It is, however, a better shaped and more active dog than either of the two preceding breeds, with more power for hard work, but quarrelsome and given to hare-chasing. The modern English pointer is the lightest and best-shaped dog of the whole group, and is believed to have been derived from the Spanish breed, with some intercrossing either directly with the greyhound or indirectly through the foxhound.



ENGLISH POINTER.

This breed is characterised by its compact and well-knit build, sloping shoulders, straight muscular limbs, and spirited action. The head is still relatively large, but the pendulous upper lips, dewlap, and the heaviness of the throat have been lost. The nose should be long, broad, and square in front. The eyes are moderately large, soft, and intelligent, the colour varying from buff to dark brown. A peculiarly rounded outline on the upper side of the neck marks the well-bred pointer, which can hardly be described in words. The tail is as straight as possible, with no trace of a fringe, sharply pointed at the end, and carried low. The coat is soft, although not silky. With regard to colour, there are two strains, distinguished as the "lemon-and-white" and the "liver-and-white," which are the most numerous and the most esteemed; in addition to which there are entirely black and entirely liver-coloured pointers, the latter being very rare. There are also black-and-white, and black, white, and tan varieties; a dog with much white being preferred, in order that he may readily be seen among turnips. There has been much rivalry as to the merits of

the lemon-and-white and liver-and-white pointers; the one strain being in the ascendant at one time and the other at another. In the best-bred pointers the head should be carried high when at work; animals which have too much of the foxhound in their blood carrying the head down, and seeking after a "foot-scent," instead of trusting entirely to the "body-scent," while their tails are not carried in the orthodox rigid position.

Dalmatian Dog. The Dalmatian, coach, spotted, or "plum-pudding dog," is probably allied to the pointer and hounds, although there have been suggestions of its affinity to the great Dane. It is distinguished by its dark spots, which are by preference jet-black on a white ground. In the modern breed these spots are large and evenly distributed, varying in size from that of a shilling to that of a half-crown; but in the older breed they were much smaller, and more like the "ticks" or flecks of the pointer. As being in England essentially a carriage-dog, next to the regularity of its spots attention is directed to the perfect development of the limbs. In its native country the Dalmatian dog is employed as a pointer, and is said to stand well to game.

Mastiff. With the mastiff we arrive at the fifth division of domestic dogs, characterised by the more or less shortened muzzle, in which the lower jaw frequently projects beyond the upper, while the skull is greatly elevated above the eyes by the enlargement of the air-cells in the frontal bones. The typical forms are of large size and powerful build, with either pendent or erect ears, pendulous lips, and generally short coats and thin tails. They are used chiefly as watch-dogs, or for fighting. Of the true mastiffs there are two breeds, the English and the Cuban. The modern English mastiff is a powerful dog of large size, which, when pure bred, is distinguished by its fully pendent ears. The head is relatively larger, and the body less massive than in the bull-dog; the head showing a slight furrow down the middle, and the body having a slight bend. In height the male should not fall below 29 inches, while the female should reach at least 27 inches. The coat is fine and soft, but may become rather rough on the tail. The colour most esteemed is either a stone-fawn with black "points," or a brindle, without any admixture of white; but red mastiffs are not unknown.

Bull-Dog. This dog is distinguished by its hideous appearance, its ferocity, and its low degree of intelligence. Its head should be square in shape, and as wide as possible, while the skin on the forehead should be well wrinkled. The indentation between the eyes, technically known as the "stop," should be of great depth and size; while the eyes should be dark, rather prominent, far apart, and set horizontally. The ears, which vary somewhat in shape, are required to be small, and placed high on the head, although not at its summit. Breeders also attach importance to the shortness of the upper as compared with the lower jaw, this being an essential feature when the dog has to seize large animals. Needless to say, the tusks should be large and powerful, and the incisor teeth ought to form a regular series. The shape of the body and limbs is admirably adapted for the attainment of the maximum strength and power. A male should not exceed 50 lbs. in weight, while the female should scale about 10 lbs. less. The coat should be close and fine, the favourite colours being either pure white, or white marked with brindle, fallow, or red; while uniformly coloured

brindle, fallow, or red dogs come next in estimation. Entirely black or black-and-white bull-dogs are less valued.

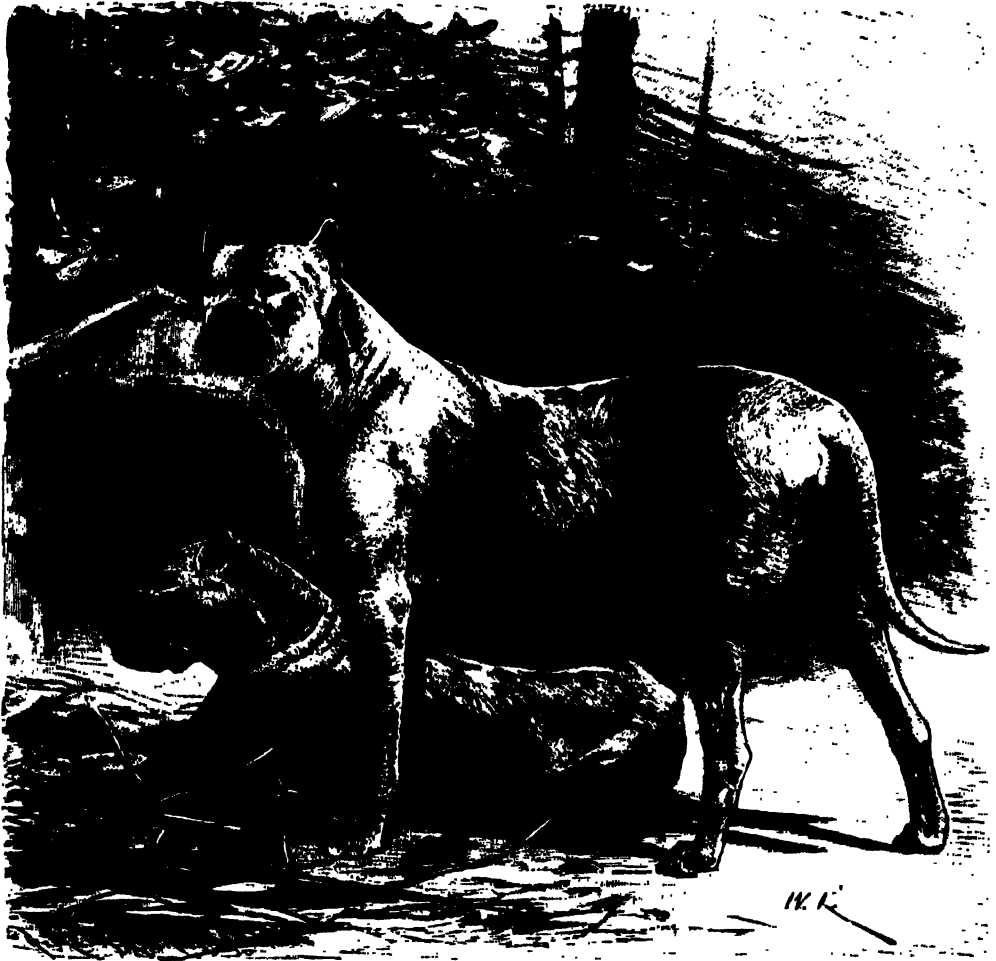


THE BULL-DOG ($\frac{1}{2}$ nat. size).

Bull-Terrier. This breed, as its name implies, is a cross between the bull-dog and the smooth terrier; but it varies in form and size according to the amount of bull or terrier blood. The jaws must be long and powerful, and the hollow between the eyes of the bull-dog should be quite eliminated, while the profile should be nearly straight. The coat should be short, firm, and close, and, in a perfect animal, should be milky-white throughout, the nose being black. The worst point about a bull-terrier is its quarrelsome disposition, which is rendered all the more objectionable by its courage and strength.

Boarhound. The German boarhound, together with the variety known as the great Dane, is the largest European representative of the mastiff group. These dogs have long been bred in Germany and Denmark, although but comparatively recently introduced into England. In their native countries they were originally used for boar or deer-hunting, but are now more often employed as watch-dogs. There is considerable variation in these dogs, and it is difficult to determine which is the true breed. "Stonehenge" regards the boarhound and the great Dane as in all respects identical, but Brehm considers them distinct, and is of opinion that while the German boarhound is a pure-bred animal, the great Dane is a cross between the bull-dog and the greyhound. The great Dane,

according to Brehm's description, is a magnificently-proportioned animal, with slender limbs, rather pointed muzzle, slender tail, and large full eyes. It is generally either yellow-and-black, or yellow in colour, and even in its native country is a comparatively rare breed. The ears are always cropped, and thus lose their pendent tips. It was formerly used in deer-hunting. The boarhound is a shorter-haired and thicker-muzzled dog, with a proportionately shorter and

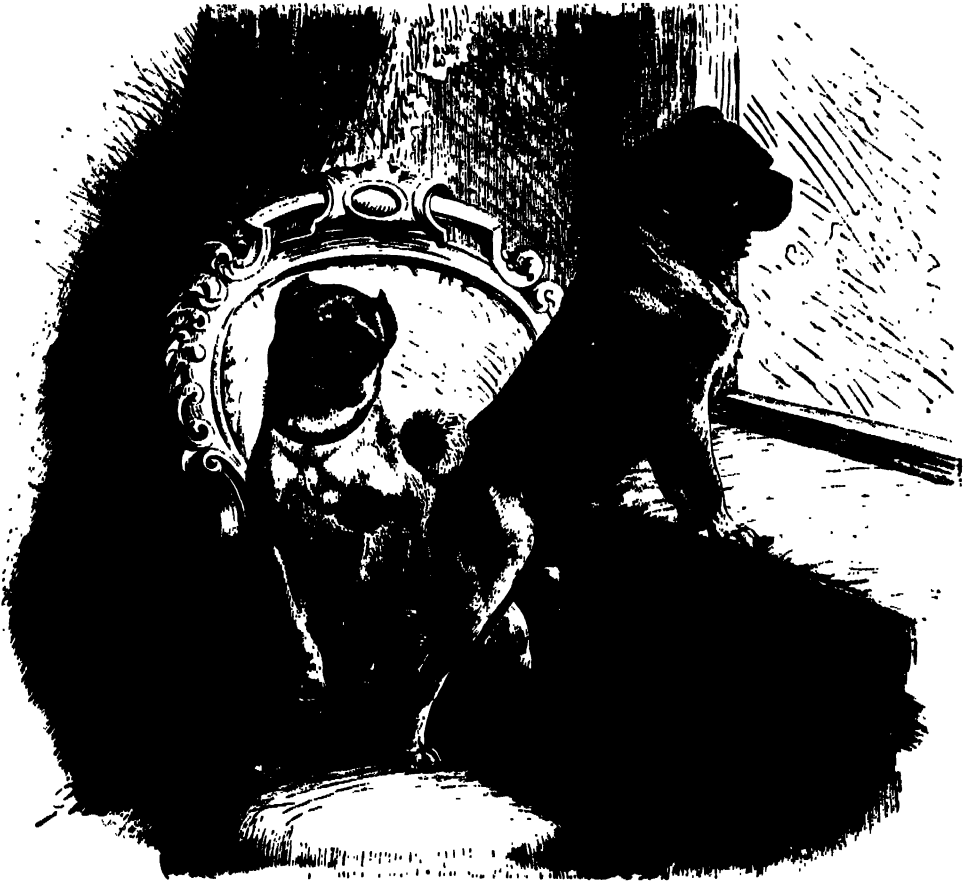


GERMAN BOARHOUNDS ($\frac{1}{4}$ nat. size).

thinner tail. The colour is generally black, light or dark grey, brown or yellow, the light shades being often brindled. There are often white spots on the chest, and one or more white toes in the lighter-coloured examples. An unusually large dog measured upwards of $35\frac{1}{2}$ inches in height at the shoulder, when in his third year. In the Black Forest these dogs are still used in boar-hunting.

The curly-tailed pug-dog, which is a diminutive member of the mastiff group, is kept solely as a pet, and has suffered considerably from the caprice of fashion in England, where it was much esteemed in the last

century, until it was suffered to fall into the neglect from which it was recently resuscitated. The colour is either yellow or stone-fawn, with black "points": these black points comprising the face and ears, an area under the tail, and a more or less well-marked streak down the back, which, in the so-called Willoughby pug, is most esteemed when it spreads out into a saddle-shaped patch. The coat should be soft, short, and glossy, except on the tail, where it should be



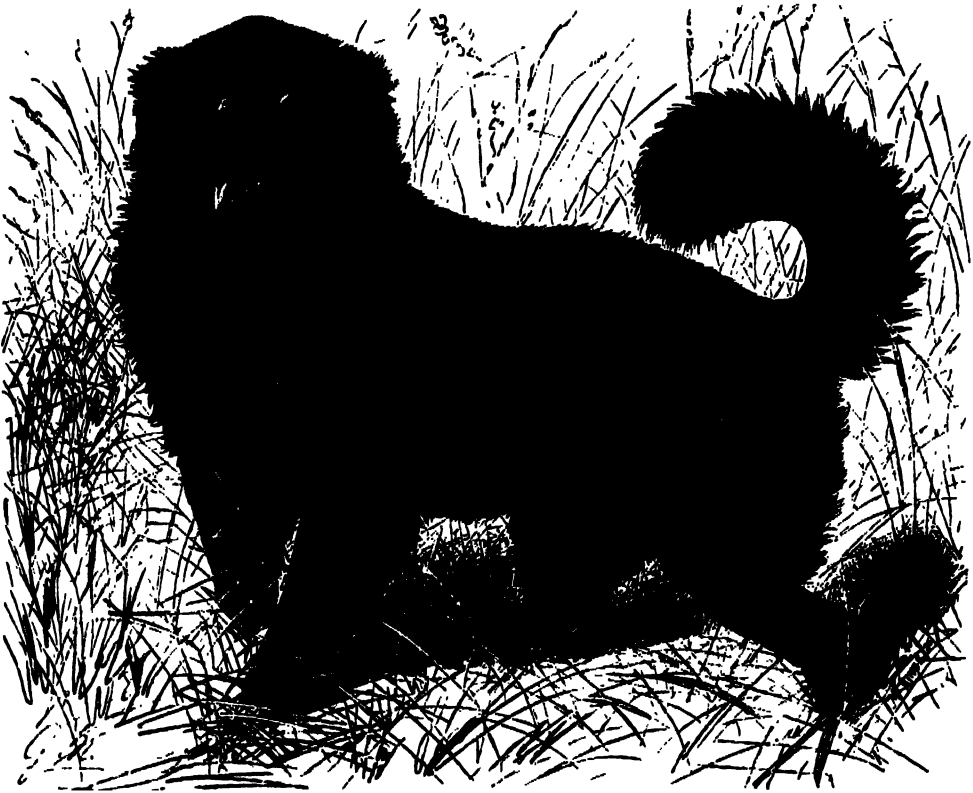
PET PUGS (1 nat. size).

rougher; the tail itself being tightly curled, so as to lie on one side of the back, with rather more than one complete turn. The head is rounded, and second only in relative size to that of the bull-dog, with a short but not retreating face. The black ears should be short, and shaped like a vine-leaf; the teeth even; and the dark brown eyes full and soft. The body is thick and "punchy," with a very loose skin: and the legs should be straight, with small bones, narrow feet, and dark nails, without any white on the toes. A black mole on each cheek, with several long hairs growing from it, is also considered an essential point in a pug.

The Chinese, or, as it is often incorrectly called from being imported into Japan and thence brought to Europe, the Japanese pug, is a still more extraordinary

animal, exhibiting a kind of degradation from overbreeding. One of these brought to England about 1867 was a slender-legged animal with very long hair, and the bushy tail closely curled over its back. The face was extremely short, and the jaws very feeble, with only a single pair of incisor teeth in the lower one. This pug lived chiefly on vegetables, and exhibited a special partiality for cucumbers.

Tibet Dog. This dog is a magnificent animal, usually placed among the mastiffs, with which it agrees in the general physiognomy, and especially the large pendulous upper lips, or "flews," as they are technically termed. It differs, however, from all other members of the group by its coat of long



TIBET DOG ($\frac{1}{2}$ nat. size).

shaggy hair, with a thick under-fur, and the large bushy tail, carried curled over the back. The development of this thick pelage is, however, probably an adaptive character due to the nature of the winter climate of the regions of which it is a native. The expression of the countenance is stern and fierce, from the deeply-sunken eyes, overhanging eyebrows, and the deep folds into which the skin of the forehead and cheeks is thrown. The ears are pendent; and the greatest development of hair is on the throat and chest. In colour these dogs may be either entirely black, black-and-tan, or tan; and in size they are fully equal to the largest European dogs.

The Tibet dog is used as a watch-dog in the villages and encampments in the

Highlands of Tibet and the neighbouring regions, extending westwards into Ladak, and southwards into Sikkim. It is invaluable in protecting the flocks from the inroads of wolves and wild dogs. On reaching a Tibetan village or encampment in the higher regions of Ladak, the traveller is assailed by the baying of at least half a dozen of these dogs, and until they are leisurely called off by the women the sensations of the visitor, as the writer knows by experience, are sometimes the reverse of pleasant. In the more eastern portions of its range the Tibet dog, in common with sheep and goats, is pressed into service as a beast of burden.

Fox-Terrier. With the fox-terrier we reach the last group of dogs, which includes the terriers, the poodle, and a few other species. All terriers have moderately short and highly-arched skulls, in which the elevation is mainly due to the large size of the brain-case, and consequently indicates a high degree of intelligence, the jaws being generally rather short, as well shown in the portrait of "Spot" which faces our list of contents.

The smooth fox-terrier was formerly used for unearthing foxes, two of these animals being attached to every pack of hounds; but is now one of the most favoured breeds of companionable dogs. It should have a hard, thick, and glossy coat, of a pure white ground-colour, more or less fully marked with black-and-tan, black, or lemon colour, liver-coloured markings being objected to. The "true hound colour," that is white and black-and-tan, is the most esteemed; and it is considered that this type of coloration has been produced by a cross with either the black-and-tan terrier or the beagle. There has been much discussion as to the advisability of a strain of bull-dog blood in the smooth fox-terrier; such strain showing itself by a tendency for the lower jaw to be "underhung," and also an unusual massiveness of the jaw muscles. The weight may vary from 15 or 16 to 20 lbs. In a pure-bred animal the head should be flat and rather narrow, tapering from the ears to the muzzle, with a slight hollow in front of the eyes, but none between them. The jaws should be long and tapering, with a moderate prominence of the masseter muscle; and the nose must be black. The eyes are small, without prominence; and the ears likewise small, in shape resembling the letter V, and set close to the cheeks, with their points directed forwards and downwards.

The rough fox-terrier came into popular favour at a later date than the smooth breed, although it had been bred for many years in the west of England. "Stonehenge" observes that it "may be regarded in all respects as similar to his smooth brother, with the exception of his coat, which on the body and legs should be about twice the length of that on the smooth dog, with the addition of a thick under-pile of a woolly nature, and furnished, like that of the otterhound, with a certain amount of oil, so as to resist the action of the water."

Irish Terrier. The rough Irish terrier, which seems of late years to have replaced the old Scotch terrier, is a rather large dog, varying in weight from 17 to 25 lbs., with a hard, rough, and wiry coat, having no tendency to curl. The most admired colour is bright reddish-bay, usually termed "red," but it may vary through different shades of brown and yellow to grey. The tail is generally cut, but if kept entire should curve. Great importance is attached to

the form of the head, which should be long and rather narrow, without any wrinkles or hollow between the eyes. When uncut, the ears should be small, filbert-shaped, and lying close to the head: without any fringe of hair, and rather



WELSH TERRIERS (A nat. siz.)

darker in colour than the head. The small eyes should be hazel, and the nose black. The rough terriers, figured in the illustration, belong to a breed known as the Welsh terrier.

Very different to either of the above is the long-bodied, short-legged, and long-haired Skye terrier, of which there are two distinct breeds, distinguished by the form of their ears and the proportionate length of the body. The first of these is the drop-eared or smooth Skye, in which the ears are pendent, and the body almost or quite as long proportionately as in the dachshund: the length of the animal, from the tip of the nose to the end of the tail, being in perfect specimens as much as three and a half times the height. The coat should nearly touch the ground, and almost conceal the shape of the body: the long hair being straight, coarse, and shiny, and naturally parting down the middle of the back, while beneath this there is a thick, woolly under-fur. The most approved colours are "blue," black, or grizzle, next to which comes silver-grey with the hairs tipped with brown, and then fawn with the tips of the hairs

also brown. The long hair makes the head appear larger than it really is. It should be rather narrow, and nearly flat at the top, with little or no elevation at the eyes. The nose and the roof of the mouth must be black or dark brown, and the ears should be about 3 inches in length. The latter should have very long hair, which, together with the long hair of the eyebrows and cheeks, should fall over the eyes. The height of the Skye terrier varies from 9 to 10 inches; the length in the former case varying from about 30 to 33 inches. The prick-eared Skye is a shorter-bodied dog, with a larger and squarer head, a rougher coat, and large, pointed, erect ears, terminating in a distinct tuft.

Much alteration has ensued in the appearance of the Skye terrier, through the fancy of breeders, but the modification is not near so great as that which has taken place in the Dandie Dimmont, whose height now varies from 8 to 11 inches at the shoulder, and weight from 14 to 24 lbs. The hair on the top of the head is soft and silky, while that on the jaws is harder and darker. The upper-surface of the tail has wiry hair of a darker tint than that of the body, while below it is softer and lighter in colour. The ears terminate in a distinct point of hair. The prevailing colour is either "blue" or "mustard," but in the former case the hair on the fore-legs and feet should vary from tan to fawn, while in the latter they should be darker than the creamy-white head. The ears vary from brown to black, and the eyes are hazel.

**Yorkshire
Terrier.**

The last of the long-haired terriers that we shall mention is the Yorkshire or Halifax terrier. This is a small breed, readily distinguished by the enormous length of the long and silky hair, especially on the face. On the body the length of the hair is about 3 or 4 inches, while on the face it reaches as much as 6 or 7, and thus communicates a most grotesque appearance. The colour on the upper-parts is a grizzled "blue," owing to the mixture of dark with light hairs, while tan occupies the same parts as in the black-and-tan terrier.



YORKSHIRE TERRIER.

Under the title of English terriers may be included the short-haired dogs commonly known as the black-and-tan terrier, with its diminutive representatives the toy terrier and the white terrier. The black-and-

tan, or Manchester terrier, is too well known to require any description. It is of about the same average size as the fox-terrier, varying in weight from some 10 or 12 to as much as 18 lbs. Especial attention is paid to the coloration of this terrier, the black being required to be of jetty fulness, and sharply defined from



SMOOTH AND ROUGH TERRIERS.

the tan, which should be of a rich mahogany. The tan should occupy a spot over each eye, and another on the cheek, as well as the sides of the jaws backwards to the lower parts of the cheeks, ending on the throat. It should also occupy all the under-parts, the inner sides of the ears, a spot on each side of the chest, the whole of the inner sides of

the limbs, their outer sides as far as the wrist and ankle-joints, and the whole of the feet, with the exception of a narrow line of black along each toe. The black-and-tan toy terrier is merely a diminutive derivative from the Manchester terrier. It should not exceed 6 lbs. in weight, and is most prized when it only weighs $3\frac{1}{2}$ or 4 lbs., if it at the same time exhibits perfect symmetry. The white English terrier is a less well-known breed, having the same general characteristics as the Manchester terrier, but of a pure opaque white colour, with dark eyes, nose, and claws.

Poodle.

Although very different in appearance to the typical representatives of that group, the poodle, which is perhaps the cleverest of all dogs, and the one most apt to learn tricks, is included among the terriers. The general appearance is so well known, and is likewise so truthfully portrayed in our illustration, that it will be unnecessary to refer to it. There are several strains, differing mainly from one another in size: the usual colours being either black or white, or a mixture of the two. The coat should resemble astrakan, but may incline more to a silky or to a woolly nature in the different strains. When clipped it should present a satiny sheen. Both on the Continent and in England the poodle is clipped to a greater or less degree: but whereas abroad the coat is permitted to grow in winter, in England the clipping is too often continued at all seasons. In England and Russia the poodle is treated solely as a companion and house-dog: but in France and Germany it is employed as a sporting-dog, and is the constant out-door companion of the farmer. It is an excellent water-dog, diving well, and seldom failing to find a wounded bird in the water; the oily nature of its coat being an admirable protection against chills. In

retrieving on land the poodle relies fully as much on its general intelligence as on its scent of smell, thereby resembling the Newfoundland; and it generally hunts by casting round in circles, rather than by following a direct trail. Poodles are generally the dogs employed in circuses as performers, and they have frequently been taught to recognise and pick out many of the cards from a pack at the direction of their masters. As a remarkable instance of intelligence, Dr. Romanes relates a case where a poodle, having on one occasion conducted his master to the larder, and been rewarded with a piece of meat, essayed to lead him again to the



WHITE AND BLACK POODLES (7/8 full size).

same spot. Being baffled in this attempt, the dog thereupon took up his master's hat, with which he proceeded to the larder, and lay down beneath the shelf on which was placed the coveted joint.

Maltese Dog.

This dog may be compared to a diminutive Skye terrier, and should not exceed some 5 or 6 lbs. in weight. It has a short body, and is covered with very long and silky hair, which is of a uniform semi-transparent white colour, the tail being thickly haired and carried tightly curled over the back. The nose and roof of the mouth are black; and the hair of the moderately long ears, as in other terriers, mingles with that of the neck.

Mexican

Lap-Dog.

The Mexican lap-dog is also pure white in colour, but with a flesh-coloured nose. The hair on the head and body is moderately long and curly, but that of the rather short tail longer and straighter. The ears

are small and not pendent, and the head rounded, with the brown eyes widely separated from one another. An apparently adult specimen of this diminutive breed preserved in the British Museum measures only 7.1 inches from the tip of the nose to the root of the tail.

ASIATIC WILD DOGS (*Canis alpinus*, *deccanensis*, etc.).

With the Siberian wild dog (*C. alpinus*) we revert to the consideration of the wild members of the *Canide*. It belongs to a small group of Asiatic species,



SIBERIAN WILD DOG (½ nat. size).

distinguished from other representatives of *Canis* by the loss of the last molar tooth on each side of the lower jaw, so that the total number of teeth is forty instead of forty-two. The group is further distinguished by the shorter muzzle and the slightly convex profile of the face. On account of these and certain other points of difference—more especially the presence of either twelve or fourteen teeth, instead of the usual ten—these species are frequently referred to a distinct genus, under the name of *Cyon*. Another distinctive feature of these animals is the presence of long hairs between the pads of the feet. The whole of these dogs are in the habit of hunting in large packs, and are noticeable on account of their courage and handsome appearance: the tail being bushy and equal in length to about half the head and body. Since there is no doubt that they are not the

ancestral stock of any of the domestic dogs, the name "wild dog" is to a certain degree a misnomer.

Siberian Wild Dog. This species is an inhabitant of Northern Asia, extending from the country from which it derives its name, at least as far southwards as the Altai mountains, and probably still further. It may be distinguished from the following species by the circumstance that its molar teeth, especially those of the upper jaw, are of larger size. Like its southern cousin, the Siberian wild dog is subject to seasonal and individual variations in the colour of its fur. In summer it seems to be generally of a foxy-red colour, becoming darker on the back and lighter on the under-parts and the inner surfaces of the limbs. There are, however, two skins in the British Museum characterised by their long and woolly hair, of which the colour in one is white, and in the other a yellowish white; and these may be presumed to indicate the winter dress.

According to Rade, the Siberian wild dog is a forest-loving animal; generally frequenting mountains like those on the east bank of the Yenesei where forests are abundant, but occasionally appearing on the open steppes. It is locally distributed; and while in some localities it preys largely upon deer, in others it is in the habit of hunting ibex. In the Altai these dogs go in troops of from ten to fifteen, or more individuals, led by an old male; and where they hunt deer it is generally hinds or young animals that they select for pursuit. So incessant is their persecution of the deer that they will sometimes cause them to completely desert certain localities: this having taken place in the year 1859 in the valley of the Irkut.

Indian Wild Dog. The Indian wild dog (*C. decanensis*) is perhaps the best known member of the group, and is distinguished from the preceding species by the smaller size of its molar teeth. Like the others, its general build is more jackal-like than wolf-like; this being especially shown by the comparative shortness of the legs. It agrees with the Siberian species in the length of the fur, and in the presence, at least in Himalayan examples, of a thick and woolly under-fur. The general colour of the fur of the upper-parts is a rusty red, varying in some specimens to a rufous, or even a light brownish grey; the under-parts being paler. Generally the end of the tail is black, but its extreme tip may occasionally be whitish. The young are of a uniform sooty-brown colour. A specimen measured by Hodgson had a length of $37\frac{1}{2}$ inches, exclusive of the tail; the latter measuring $14\frac{1}{2}$ inches with the hair and 8 inches without the same. This wild dog is found throughout the forest-clad portions of the Himalaya, from Kashmir to Assam, and in Gilgit, Ladak, and Eastern Tibet. Southwards of the Himalaya, it is found in the larger forests of India, although it is unknown in Ceylon. In inhabiting alike the forest of peninsular India and the forest-clad regions of the Himalaya, as well as the treeless districts of Tibet, the Indian wild dog presents an instance precisely analogous to that of the lynx, already noticed. Hodgson, who alludes to the animal by the Himalayan name of buansu, states that although the Indian wild dog is "not deficient in speed or power of leaping, yet his motions all appear to be heavy, owing to the measured uniformity of his pace. He runs in a lolling long canter, is unapt at the double, and upon the whole is somewhat less agile and speedy than the jackal, and very

much less so than the fox. The wild dog preys both by night and day, but chiefly by day. Six, eight, or ten unite to hunt down their victim, maintaining the chase by their powers of smell rather than by the eye. . . . The buansu does not burrow like the wolf or the fox, but reposes and breeds in the recesses and natural cavities of the rocks." After stating that the number in a pack may occasionally be as many as twenty, Mr. Blanford observes that these wild dogs "live principally upon deer of various kinds and wild pigs in India, and on wild sheep and antelopes in



INDIAN WILD DOG: (1 nat. siz.).

Tibet. Many sambar and spotted deer are killed by them, whilst occasionally nilgai and Indian antelopes fall victims. Wild dogs avoid the neighbourhood of man, and consequently but rarely attack domestic animals; occasionally, however, they kill sheep, goats, and cattle, and Jerdon mentions one instance, and M'Master another, of their pulling down a tame buffalo. I came across a third case myself in the jungles east of Bawda, and I was curious to see how so large an animal had been destroyed. There were but a few tooth-marks about the nose and throat, and some of the pack had evidently attacked the buffalo in front, while others tore it open. This is probably their usual way of killing large animals; they have been seen to snap at the flanks of a number running." It was stated by Hodgson that

wild dogs are in the habit of giving tongue while hunting. This is, however, denied both by Hamilton and Blanford; but it is affirmed that these animals are in the habit of howling at night.

There does not appear to be any authenticated instance of the Indian wild dog attacking human beings. In marked contrast to the wolf and the jackal, it is, if not absolutely untamable, exceedingly difficult to render domesticated in any degree; this of itself being a proof that it has nothing to do with the ancestry of domestic dogs. The young in India are born in the winter, although this is probably not the case in the higher Himalaya and Tibet. The number of cubs in a litter is usually from two to four, but six or more have been observed. In the Himalaya, near Simla, a breeding-place was discovered where it appeared that several females bred in company.

By many writers the wild dog of the countries to the eastward of the Bay of Bengal is regarded as inseparable from the Indian form. Mr. Blanford, however, takes the opposite view, and considers that the



MALAY WILD DOG ($\frac{1}{2}$ nat. size).

Malayan wild dog is entitled to rank as a distinct species (*C. rutilans*). It is smaller and slighter in build, and has slenderer limbs than its Indian relative; while the "brush" is smaller, and the hair of the body is short and harsh, and has no under-fur. There is also stated to be a difference in regard to the relative length of the flesh-tooth of the upper jaw to the two molars by which it is followed. In colour this dog is of a deep ferruginous red above, with the individual hairs scarcely lighter at their roots; while the under-parts of the body are whitish. Mr. Blanford gives the length of the head and body of a young male as $32\frac{1}{2}$ inches, and that of the tail 12 inches. This species is found throughout the Malay peninsula, and also in the islands of Sumatra and Java, while it has also been reported to occur in Borneo. It is also found in Tenasserim, and has been obtained near Moulmein; but it has yet to be determined whether the wild dog of Upper Burma belongs to this or the preceding species. It may be suggested that in the latter district it will be found that the specimens indicate a more or less complete transition between the two species.

Extinct Species. In concluding our notice of the wild dogs of this group, it may be mentioned that remains of extinct species are found in the cavern deposits of France and Germany. These fossil species appear to have been closely allied to the living ones; and afford one more instance of the derivation of the present fauna of the East from the ancient fauna of Western Europe.

THE MANED WOLF (*Canis jubatus*).

With the so-called maned wolf—a name which is in every respect a misnomer, since the creature is neither distinctly maned nor a true wolf—we come to the first of a group of South American species, which form the remaining representatives of the wolf-like section of the family. The maned wolf, which is of about the same size as the common wolf, differs from the rest of these South American species by its superior size, longer legs, and shorter tail. It is placed by Professor Mivart among the true wolves, but its appearance and habits are so different that we are persuaded that its proper place is here.

The aguara-guazu, as this animal is termed in South America, is a long-legged and long-eared species, with a very conspicuous coloration. The body is covered with long and somewhat coarse hairs, which are more lengthened on the back of the neck than elsewhere; the general colour being of a bright yellowish red. There is, however, a black patch extending from the nape of the neck towards the shoulders, and black is also present on the under-surface of the lower jaw. Moreover, the legs have black "stockings," standing out conspicuously against the general red colour of the body; while the under-surface of the upper part of the throat, as well as the insides of the ears and the extremity of the tail are white.

The maned wolf inhabits Brazil, Paraguay, and Northern Argentina, but does not extend as far south as the Pampas. It differs from the true wolves in being an entirely solitary animal—never assembling in packs, and also in being harmless to men. Generally found in moist regions, it lies concealed during the day in bushes and thickets, and does not venture forth till evening for its nocturnal wanderings. It preys generally upon the various species of rodents which are so

common in South America, some of which are so swift as to elude the attacks of domestic dogs, although they fall a ready prey to the maned wolf. Its diet is, however, varied by birds, reptiles, insects, and even fruits; while it will sometimes attack deer, and more rarely sheep. Owing to its nocturnal habits the maned wolf is rarely seen in inhabited districts, but it appears that in regions remote from human habitations it is less cautious in its habits and will issue forth during the day-time.

OTHER SOUTH AMERICAN SPECIES (*Canis azarae*, etc.).

Azara's Dog.

The comparatively small and fox-like species known as Azara's dog (*C. azarae*), is the best known of several South American species in regard to the nomenclature of which there has been much confusion. This dog differs from all the species yet noticed by its fox-like appearance, this being especially shown by its long body, short legs, large ears, and long bushy tail. If, however, we were to assume from this that the creature was nearly related to the European fox, we should be in error, since it has a skull agreeing with those of the wolves and jackals, and quite unlike those of the true foxes, which are unknown in South America. This species is found from Brazil to Tierra del Fuego, and also on the western side of the Andes in Chili and elsewhere. It is true, indeed, that there is great variation in the colour of specimens from different regions, on which account a number of nominal species have been determined; but these are all regarded by Professor Mivart as local races of one species. It likewise appears that there is a considerable amount of seasonal variation in the colour and length of the fur in the same individuals; the hairs being longer and greyer in winter than in summer, while those on the back tend to blackness, and those on the face to a greyish brown instead of a yellowish grey tint during the former season.

In the average form the colour of the sides of the body is grey, while the longer hairs of the back are black-and-white, with black patches on the shoulders, the middle of the body and the rump; the limbs being fulvous externally, and of a pale yellowish tint internally. The under-parts of the body and the inner sides of the thighs are whitish. There is also some white on the upper lip, and on the chest, as well as on the inner sides of the ears; the outer sides of the latter being yellowish, with black tips. The tail, like the back, is mottled with black-and-white throughout the greater part of its length, but the end is black. White specimens have occasionally been observed.

Mr. W. H. Hudson speaks of Azara's dog as being purely fox-like in its habits, and common everywhere in Argentina, where it inhabits the open Pampas. In Paraguay, on the other hand, according to Rengger, it dwells in jungle-clad districts, from which during the night it roams on the one side into the dense forests, and on the other into the open country. Its main food consists of small mammals and birds, but it will not refuse lizards; and it displays a marked partiality for sugar-cane, doing great damage, by the number of canes it destroys without eating them. In hunting, this dog runs with its nose close to the ground, after the manner of a foxhound, but will at times raise its head to the wind. For the greater part of the year Azara's dog is a solitary animal, but during the winter

pairs of males and females go together. The young are born in the spring, and generally comprise from three to four in a litter. The lair may be formed either beneath the cover of a thick bush, or in the deserted hole of another animal, such as an armadillo, but it does not appear that the aguarachay (as this species is termed in South America) ever burrows for itself.



AZARA'S DOG.

Crab-Eating Dog. The crab-eating dog (*C. caracivorus*), is a rather larger species than the last, sometimes attaining a considerable size; and having a relatively shorter muzzle and tail. It inhabits the regions from Guiana and Demerara to La Plata, although said to be unknown on the Pampas. The colour is subject to great individual variation, but according to Mivart its pervading tint may be either a uniform light reddish grey, or darker and mottled. It may have a black back and bright red legs, or may be a dull grey, with very little black, or grey with a very black back. The most normal tint seems to be a brownish grey above, with the crown of the head, sides of the body, and outside of the limbs slightly or strongly rufous. There is generally more or less black on the back and the upper surface of the tail, while the end of the tail is always black. The reddish brown ears have not the black tips of the preceding species. The carasissi, as this dog is called in some parts, is a forest or jungle-dwelling species, feeding not only upon rodents and birds but likewise upon crustaceans,

and thus earning its common English title. It is stated that these animals will collect in packs and run down and kill deer; and they do much damage to poultry in inhabited districts. Although when hunting in the woods they follow their prey by scent, it is stated that when in the open they hunt by sight.

Colpeo. The largest and handsomest of the South American fox-like species, is the colpeo (*C. magellanicus*), from Tierra del Fuego and Chili. This is somewhat superior in size to the largest individuals of the preceding species, from which it is distinguished by its longer and more pointed nose, and the great length of the more bushy tail. The coloration is, moreover, generally of a more decidedly reddish hue. Like the other species, there is considerable individual variation both as regards the colour and length of the fur. Generally, however, the sides of the body are brownish grey, while the back is mottled with black, and the limbs are more or less rufous: the cheeks, throat, under surface of the lower jaw, and the under-parts being yellowish-white. The ears are dark externally; while the bushy tail is of a light reddish grey, except the tip and a patch on the upper surface near the root, which are black. The colpeo, as Darwin remarks, inhabits alike the moist forests of Tierra del Fuego and the arid deserts of Northern Chili. It is very destructive to poultry: and, though to a large extent nocturnal, may frequently be seen during the daytime.

Short-Eared Dog. Our knowledge of the very remarkable species known as the short-eared dog (*C. microlis*) is limited to a single specimen, formerly exhibited in the London Zoological Society's Gardens, and believed to have come from the valley of the Amazon. This animal was about the size of medium individuals of the crab-eating dog, measuring 42 inches in total length, of which 12 are occupied by the tail, and standing about 14 inches at the shoulder. It differs from the other members of the family, except the next, by its short and rounded ears, which communicate to the face a physiognomy quite different from that of all other wild dogs. It is further noticeable for its coloration, the fur being short and thick and generally of a dark iron-grey hue, the individual hairs being black at the tips and white near their roots. The limbs and bushy tail are nearly black, but the latter has a curious white patch on the under surface near the root. The ears and snout are rufous.

THE RACCOON-DOG (*Canis procyonoides*).

This curiously-coloured and short-eared species is an undoubted dog, and comes nearest to the South American forms described above. It receives its title from a supposed resemblance to a raccoon, but it must be confessed that it requires a considerable amount of imagination to see the likeness. The raccoon-dog inhabits Japan, China, and Amurland, and is characterised by the sharp and pointed muzzle, the short rounded ears, the rather short and bushy tail, and the great length of its fur, more especially during the winter. There is much individual variation in colour, the prevailing tints being dusky-yellow and black, but the proportions in which the two occur differing greatly. Black is, however, always present on the cheeks and around the eyes, extending forwards to the muzzle, where there is a white spot below the nose on each side. The sides of the head

are yellowish, and the forehead may be either of the same colour or blackish. The ears have brown margins, but are white internally, and sometimes partially so externally. The chin and front of the neck are brown, but, as in the specimen on the right side of our illustration, a yellowish colour may extend backwards towards the shoulders. The whole of the back has fur varying from a mixture of black-and-yellow to nearly black, the individual hairs always having long black tips. On the sides, the ends of the hair are yellowish; and the chest and under-parts vary from brown to nearly black, while the limbs are blackish brown. The tail, on which the hairs are long and pendent, is frequently black above and at its



THE RACCOON-DOG ($\frac{1}{2}$ nat. size).

extremity, while below it may be light yellow. The raccoon-dog is chiefly a nocturnal animal, dwelling in summer in the wood-clad mountains, and in winter descending to the neighbourhood of the river valleys, where it is said, when in good condition, to hibernate. In Amurland, where it does not hibernate, it feeds largely on fish during the winter, reposing during the day in the thick sedges of the river banks. The asserted hibernation of this animal is a remarkable feature, since no other member of the family takes a winter sleep. The hibernation is said to take place in the deserted burrow of a fox, or some other animal: but it can also construct an earth of its own. The individuals which do not hibernate may be seen in winter crossing the ice-bound rivers in a succession of short jumps. The raccoon-dog is far from wary, and as it is almost



W. Kuhnert.

COMMON FOX

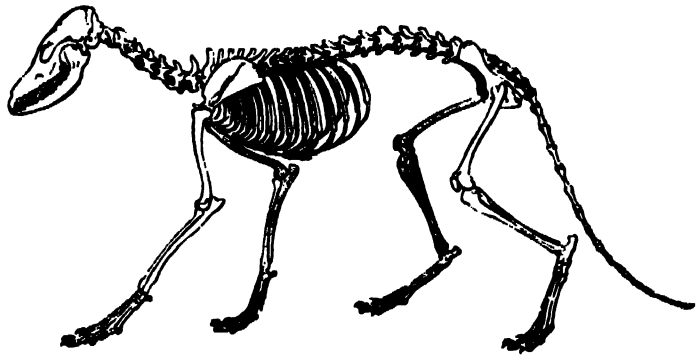
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omnivorous in its food, is easily killed by means of strychnine. The fish which forms its favourite diet in winter is a kind of carp; while in summer the chief food consists of mice, which are pursued either in small companies or family parties. Fruit also forms a portion of its diet. It does little or no damage to poultry; and in Japan has been known to make its winter lair beneath the walls of a house. Both its fur and its flesh are held in high estimation by the Japanese.

THE FOXES (*Canis vulpes*, etc.).

One of the characteristics by which the skulls of the wolves and the other members of the dog family described above may be distinguished from those of the foxes has been mentioned on p. 496. To this it may be added that the frontal bones of the skulls of the former group are inflated by internal air-chambers, which are wanting in those of the latter. Moreover, the pupil of the eye, when contracted, is circular in the wolves, jackals, and domestic dogs, whereas in the foxes it is elliptical. Some of the fox-like South American species of the former resemble, however, foxes in this respect, as they do in external form to a more or less marked degree. On account of these intermediate forms, we cannot agree with those who refer the foxes to a distinct genus, although they differ from all other members of the family in having but six teeth. Foxes are characterised by their slight build, their long bushy tails, which are nearly always considerably more than half the length of the head and body, and short limbs; while they generally have large ears. All the members of the group are chiefly nocturnal in their habits, hiding in holes or burrows made by themselves, or in ravines, or amongst grass or bushes during the day. They are, as a rule, solitary, and rarely if ever associate in numbers as other *Canidae* do. All the species are more or less insectivorous and frugivorous; but the more tropical forms appear to live on insects more than do those which inhabit temperate climates. All are highly intelligent and famous for cunning. The group is distributed over North America, Asia, Europe, and Africa, but is unknown in South America. The smaller African species are distinguished by the inordinate length of their ears.



SKELETON OF FOX.

Common Fox.

Probably every Englishman thinks he knows the common fox sufficiently well to run no risk of confounding it with any other animal; and if our observations were confined to the ordinary foxes of Europe we should have no great difficulty in deciding that they might be included under one

name, although even among these there is a considerable amount of variation in *size and colour*. When we take into consideration the larger foxes of North America and India, we find a number of forms which, while approximating more or less to the British animal, yet differ so remarkably in coloration that it is at first sight hard to believe that they all belong to the same species; but the researches of zoologists have shown that all these various modifications pass more or less completely into the coloration of the typical European fox, and must be regarded as mere local varieties of that widely-spread species.

Including, then, all these varieties under one title, the common fox has a more extensive distribution than any other member of the entire family; its range embracing the whole of Europe and Asia, north of and including the Himalaya, from Iceland to Japan; and also comprising North America from Hudson's Bay and Labrador to the latitude of Northern Mexico, and Africa north of the Sahara and Sudan. The size of the fox, according to Mivart, is subject to such an amount of variation—that if the length of the head and body of a specimen at one end of the series be represented by 100, that of the one at the other will be equivalent to 170. The length of the tail and ears is, however, much less variable.

The ordinary English fox, as represented in our coloured Plate, is of a reddish brown colour above, and white beneath, while the outer surfaces of the ears, and portions of those of the limbs are black, and the extreme tip of the tail is white. Occasionally, however, the tip of the tail may be dark grey, or even black, while in one specimen caught in Warwickshire, the whole of the under-parts were greyish black. The total length of the head and body may vary from 27 to 46 inches, and that of the tail from 12 to 15 inches.

In Southern Europe, black-bellied foxes are far from uncommon, and connect the ordinary form with the Himalayan variety, which has a somewhat similar coloration, and is altogether a paler animal than the English fox. In its long winter dress, the Himalayan fox (which is generally smaller than the English), is a strikingly handsome animal, with the fur of the back varying from chestnut to dull rufous, more or less speckled with yellow, to a dark iron grey. Frequently there is a dark stripe across the shoulder, bordered with buff patches in front and behind; while the hinder parts of the back and thighs are greyer and more speckled with white, the sides paler, and the under-parts varying from cream-colour to nearly black. The throat and chest, with the exception of a white spot in the centre of the latter, are frequently darker than the under-parts of the body, in which the dusky area may be confined to a streak along the middle. Like the English fox, the outer sides of the ears are black, and the tip of the tail is white; but the limbs have little or no black, and the general colour of the tail is greyish, with a more or less marked rufous tinge. The face is rufous, with a black spot below the eyes; while the cheeks are whitish. Very different is, however, the appearance of the animal in summer, after the loss of its long winter coat, when the dark under-fur communicates a greyish brown tinge to the back, while the sides are paler and the under-parts nearly white. This variety is found in the Western Himalaya, from Nipal and Kashmir to Gilgit. In the higher Himalaya, Tibet, and probably Afghanistan, it is, however, replaced by another and larger variety which extends over the greater part of Central Asia. This large Central

Asian fox is a paler-coloured and yellower animal as a rule, with very thick fur, and a superb brush. The Japanese fox is somewhat variable in colour, but has been declared to present no points of specific distinction; and the same holds good for the foxes of Siberia and China. The North African fox, which has also been considered a distinct species, must likewise be regarded merely as a variety.

**American
Varieties.**

This disposes of the foxes of this group found in the Old World, and we turn to those of North America, where there is a greater range of variation in colour and markings. These American foxes have received distinct names, according to their coloration. Among these, the so-called red fox is usually of a reddish yellow colour, with the hinder part of the back grizzled, the throat, and more or less of the under-parts white, the outer surfaces of the ears



ARCTIC FOXES ON THE ICE.

black, and the tail, except at the white tip, with black extremities to the hairs. The cross-fox, as its name implies, is characterised by the presence of a transverse dark stripe across the shoulders, and of another running down the middle of the back. The tail is darker than in the red fox, while the legs, muzzle, and under-parts, are nearly or completely black. The beautiful silver, or black fox, of which the fur is so highly valued, is usually nearly or entirely black, with the exception of the tip of the tail, which is generally white. It derives its name from the grey rings usually marking the otherwise black hairs of the hinder half of the back, the head, and the thighs, which communicate the peculiar silvery lustre to the fur. Individuals may, however, be met with, in which the fur is either completely black or completely grey. That the red fox and the cross fox are undoubtedly a single species is conclusively proved by a statement of Audubon to the effect that both varieties may be found in a single litter of cubs. While the red and cross varieties

are characteristic of the eastern districts of the United States, the far rarer silver fox is a northern form, a large number of its skins coming from the upper reaches of the Mississippi, and the districts to the north-west of the Missouri River.

Habits.

So much has been written about the habits of the English fox that our remarks on this subject will be brief. Although the fox is by no means averse to taking possession of the deserted burrow of a rabbit or a badger, it generally excavates its own "earth," in which it spends a considerable portion of its time. As all hunters know, foxes, however, frequently prefer to live out in the woods, those with a northern aspect being, it is said, generally avoided. Sometimes these animals will prefer a thick hedgerow, or a dry ditch, while we have known them to select the tall tussocks of coarse grass in swampy



AN INTERESTING DISCOVERY.

meadows as a resting-place; and they have also been found in straw-ricks, where it is on record that in one instance the cubs have been born. The breeding-time is in April, and the usual number of young in a litter is from four to six. The prey of the fox consists, writes Bell, "of hares, rabbits, various kinds of ground birds, particularly partridges, of which it destroys great numbers; and it often makes its way into the farm-yard, committing sad havoc among the poultry. It has been known not unfrequently to carry off a young lamb. When other food fails the fox will, however, have recourse to rats and mice, and even frogs and worms; while on occasion beetles are largely consumed, and, on the sea-shore, fish, crabs, and molluscs form a part of its diet. Carrion seems never to come amiss; while the old story of the fox and the grapes alludes to the fruit-eating propensities of these animals." The usual cry of the fox is a yelping bark. The well-known

scent of the fox is secreted by a gland situated beneath the tail. The cunning displayed by English foxes in escaping from hounds has been so often described, that we shall make no further allusion to it here, beyond saying that it has probably attained its present development as the result of the inherited experience of many generations.

That the fox is an ancient inhabitant of the British Islands is proved by the occurrence of its fossilised remains in caverns in company with those of the mammoth and other extinct animals. This, however, is not all, for a skull, indistinguishable from that of a large English fox, has been dug up from the sands lying at the top of the Red Cray of Suffolk, which are vastly older than the mammoth period.

A very different animal from the red American variety of the common fox is the grey fox (*C. virginianus*) of North America, which is regarded by Professor Mivart as exhibiting some approximation to the



THE GREY FOX ($\frac{1}{2}$ nat. size).

fox-like South American species described above. It is a considerably smaller animal than the average European fox; and is characterised by the grizzled grey colour of the top of the head and the upper part of the body; in marked contrast to which is the rufous tint of the fur of the sides of the throat and body and the limbs. The upper-surface of the tail is dusky, while below it is chestnut; its extremity being dark, and there being also a dark patch near its root, connected with a dark mark running along the back. The chin is black, as is a spot on each side between the nose and the eye; the outer surfaces of the ears are rusty red; the middle of the throat is nearly or quite white; while the under-parts of the body are yellowish white. The grey or, as it is often called, the Virginian fox, is found from the United States to Central America.

Dr. Ellzey, when contrasting the habits of the grey fox with the red American variety of the common species, observes that the two animals differ very widely in these respects. "So far as my personal observations inform me," he says, "the following are some of the principal distinctions. First, as to reproduction, the red fox nearly always brings forth its young in an earth den, the grey fox generally in a hollow log or tree, or, at most, under a rock. The last one I found with her young was a grey. The young, only a few hours old, were in the hollow stump of an old rotten tree, broken off about five feet high. As I came up, the old one jumped out of the top of the stump, and ran off. I looked down the hole, and saw at the bottom five young ones, scarcely dry. I have seldom seen a grey with more than five, and often with only four young. I never found a red with less than five. I have seen one with nine, and several with seven. I think it certain, therefore, that the reds are more prolific. Second, as to hunting for prey and subsistence. The reds are bolder in pursuit, and hunt over a much greater territory than the greys. Whether the greys ever climb trees in pursuit of prey I am uncertain, but they take to a tree as readily as a cat when run hard by hounds. I think it nearly certain that they climb for persimmons and grapes. Red foxes never climb trees under any circumstances: when hard run they go to earth. Grey foxes run before hounds only a short distance, doubling constantly and for a short time, when they either hole in a tree, or climb one. I have known the red fox to run straight away nearly twenty miles. Very commonly they run eight or ten miles away, and then run back in a parallel course. I have known them to run the four sides of a quadrilateral, nine or ten miles long by about two miles broad. It is doubtful whether a first-rate specimen of the red fox, taken at his best in point of condition, can either be killed or run to earth by any pack of hounds living, such are his matchless speed and endurance. It is but a sorry pack which fails to kill or tree a grey fox in an hour's run. The young of the grey fox closely resemble small blackish puppies; those of the red fox are distinctly vulpine in physiognomy when only a few hours old."

Kit Fox.

The smallest and prettiest of the North American species is the kit fox (*C. velox*), which derives its Latin name from its extraordinary fleetness. In this fox the length of the head and body is only 24 inches, and that of the tail, without the hair, 9 inches. The animal is characterised by the shortness and stoutness of its limbs, standing relatively lower than the common fox, and also by the bushy tail being less than half the length of the body. The thickly-furred ears are also relatively shorter than in the common fox. Another distinctive character is the length and abundance of the under-fur, which is often visible externally, and also by the long hairs clothing the soles of the feet. In colour the kit fox is somewhat variable, but a specimen described and figured by Professor Mivart has the back and tail dark grey, mingled with black-and-white hairs, the tip of the tail black, the cheeks, shoulders, flanks, and the outer surfaces of the limbs rufous, and the under-parts white. The kit fox is confined to North-Western America, where it inhabits open treeless districts, constructing its own burrows in the ground. It was formerly abundant on the plains of Columbia, and also in those lying between the Saskatchewan and the Missouri rivers, but it has of late years considerably decreased in numbers.

Arctic Fox.

Widely different from all the other species is the Arctic fox (*C. lagopus*), characterised by the difference between its summer and winter dress, as well as by certain peculiarities in its form and habits. This species, which appears to inhabit nearly the whole of the known Arctic lands, descending in America to latitude 50°, and in the Old World to 60°, has a less pointed muzzle, and much shorter and more rounded ears than any other fox, while the hinder-parts of the cheeks are bordered with a kind of ruff of long hairs, and the soles of the feet are covered with a thick coat of woolly hair, which is most developed in winter. In the summer dress the hair is of moderate length, and is frequently of a brown or dull rufous colour on the head, back, outer sides of the limbs and tail: the under-parts being yellowish white. The under-fur is bluish



ARCTIC FOX IN SUMMER DRESS (A NAT. SIZE).

grey, and the roots of the long hairs are also of the same tint; and when this bluish grey extends farther up the hairs than usual the general colour of the fur is of the same hue. In other cases, as in the accompanying illustration, the whole of the upper-parts and the outer sides of the limbs are bluish grey, while the flanks and under-parts are almost white.

With the assumption of the winter dress the fur becomes longer and thicker, and the white hairs which are scattered through the summer coat gradually increase in number, at the same time as the tips of the other hairs become white, until the whole length of each hair is of that colour. The animal is then completely clad in white, the naked tip of the nose being, however, black, while in certain cases the extremity of the tail may also be black. A specimen in the pure white winter dress is represented in the foreground of our second illustration. This winter change of colour is, however, by no means of constant occurrence; grey hairs sometimes largely mingling with the white, while at other times the prevalent hue of the fur is a uniform bluish grey, as shown in the upper figure of our second

illustration. Moreover, occasionally, pure white foxes are to be met with in summer. In Iceland, where the winter is less severe than in the more northerly regions, the winter dress of the Arctic fox is nearly similar to the summer one, so that these animals are "blue" at all seasons.

The assumption of a white dress in winter is in order to assimilate the colour of the animal to that of the snow-fields among which it dwells, and it is somewhat difficult to understand why the change does not invariably take place in the more



ARCTIC FOX, IN WINTER DRESS ($\frac{1}{2}$ nat. size).

northern regions. The hair clothing the soles of the feet is to aid the creature in obtaining a sure foothold on frozen snow and ice.

According to Richardson, Arctic foxes, which were formerly abundant on the shores of Hudson's Bay, dwelt there in small colonies of from twenty to thirty burrows each. During the autumn and winter such of these foxes as inhabit the more northern districts of Arctic America undertake a southerly migration, keeping as much as possible to the coasts, and the length of the migration depending to a considerable extent whether the line of the coast coincides with the line of march. The Arctic fox preys largely upon birds, especially upon various members of the auk family, as we learn from Professor A. Newton, who writes, that "the Arctic fox is pretty numerous along the shores of the Ice Sound [Spitzbergen]; and we not only frequently saw examples of it, but in the immediate neighbourhood of the

cliffs wherein the *Alcida* were nesting one could, by listening almost at any time in the twenty-four hours, hear its yapping bark. It is of course the chief enemy of all the different kinds of birds, and their dread of it appears to influence them greatly in their choice of breeding quarters. What the foxes do to get a living in winter, when the birds have left the country, is one of the most curious questions that has presented itself to my mind for some time. The greater number of them are said to remain on the land and to be as active during the long polar night as they are in summer: yet there are no berries by which they might eke out their existence, and there can be no open water, on the margin of which they might find food within miles of their haunts. The most natural explanation that occurs to one is that they lay up a stock of provisions; but nobody, that I am aware of, has ever found such a store-closet." Not only does this fox prey upon the Arctic birds themselves, but it also robs their eggs. Dr. Packard, when describing his experiences in Northern Labrador, writes that on a certain day "I started up a blue fox, which was running towards me with a murre's [guillemot's] egg in his mouth; on my throwing a stone at him he dropped his egg and scampered off. I hallooed for nearly ten minutes for some one with a gun to come and shoot him, and kept him in sight. With more of curiosity than fear he would stop at intervals to look at me, keeping a safe distance off and barking, until he disappeared. Soon Mr. W. came up; we pursued, finding him on the other side of the island, with another egg in his mouth. Mr. W. gave him his death-wound, though he ran some distance with the egg between his teeth before he dropped dead. His flanks and belly were white, the rest of a slate-blue colour, his legs very long, and tail long though not very bushy. The more remarkable features were his short, rounded ears, as if cropped." It is not, however, by any means solely on birds and their eggs that the Arctic fox subsists, as in some districts it also preys largely upon the small Rodents known as lemmings. In one district during the Arctic Expedition of 1875, under Sir G. S. Nares, numbers of dead lemmings were discovered which had been killed by these foxes, and hordes of lemmings were pulled out from the crannies of the rocks, which had been collected by the foxes as a winter provision; thus confirming Professor Newton's suggestion as to the probable manner in which these animals subsist in winter.

Desert-Fox.

With the desert-fox (*C. leucopus*) of South-Western Asia we revert to the foxes of the temperate and tropical regions of the Old World. This species is considerably smaller than the common fox, the length of the head and body varying from 19 to 22 inches, and that of the tail from 12 to 16 inches. It agrees, however, with that species in having a small white tip to the tail, as it also does in the dark-coloured ears. Moreover, when the full tints are developed, this animal is more strikingly coloured than the common species, although there is a considerable amount of individual variation in this respect. When fully coloured, the fur of the back varies from brownish yellow to rusty red, and there is usually a distinct pale patch on each side of the back behind the shoulders, in front of which is a dark transverse stripe across them. The sides are lighter, while the under-parts generally vary from slaty-grey to blackish, the chin, and generally a spot on the chest, being white. In summer the dark under-fur is seen through the ordinary hairs, and the whole colour is greyer, the



THE CORSAC FOX ($\frac{1}{2}$ nat. size).

varieties of one species. The range of the corsac extends from the banks of the Volga and the shores of the Caspian Sea to the south-eastern parts of Siberia; while eastwards it is doubtless continued into China, although its limits in this direction, as well as to the northward, are unknown. It has been obtained from Amurland. Like the desert-fox, the corsac is entirely restricted to open and more or less desert regions. It preys largely on small rodents, such as voles, picas, and the like, and is chiefly nocturnal. It does not appear that it makes a burrow for itself, generally tenantry the deserted hole of a marmot, which it leaves after a time for that of another. The corsac is soon run down by dogs, and when tracked to its lair through the snow in winter is said to remain below, and rather than bolt perish from hunger.

The little-known Tibetan fox (*C. ferrilatus*), from the neighbourhood of Lhasa, is another nearly-allied small species, distinguished by the relatively shorter ears being pale rufous instead of dark-coloured; the tip of the tail being white.

Indian Fox.

The pretty little Indian fox (*C. bengalensis*), which, with the exception of an allied species, is the smallest of the true foxes, and is familiar to all who have resided in India, being often to be seen in the early morning close to the fort at Calcutta. The Indian fox, known like the other species in its native country by the name of lumri, measures only 20 inches from the tip of the snout to the root of the tail, while the length of the tail varies from 13 to 14 inches. The tail is thus shorter in proportion to the head and body than in the common fox, and the limbs are characterised by their slenderness. Although subject to the usual variation characteristic of the foxes, the general colour of the fur of this species is grey, with a more or less marked reddish tinge, there being no cross band on the shoulders, and the tip of the tail black, while the ears are grey. This black tip to the tail, coupled with the small size of the animal, at once distinguishes this species from all the other foxes inhabiting India proper.

This fox is to be met with everywhere in India, except where there is thick forest; but it does not occur to the westward of the Punjab nor to the eastward of Assam, while its reported occurrence in Ceylon is more than doubtful. Its cry is a short yelping bark, quickly repeated three or four times. It is by no means shy, and I have shot one which had walked boldly up to within gun-shot range of my camp. Sir W. Elliot writes that "its principal food is rats, land-crabs, grasshoppers, beetles, etc. On one occasion a half-devoured mango was found in the stomach. It always burrows in the open plains, runs with great speed, doubling like a hare; but instead of striking out at first like that animal, and trusting to its turns as a last resource, the fox turns more at first, and if it can fatigue the dogs then goes straight away." Jerdon states that "the burrow which this fox makes has always several openings converging towards the centre, some of them blind, others leading towards a larger central one where the animal breeds. This is often two or three feet below the surface. The burrow is usually situated quite in the open plain, now and then in some thorny scrub. In alluvial plains the fox takes advantage of any small rise in the ground to prevent its den being flooded in the rains, and its burrow is frequently found in the dams of tanks and other artificial mounds. I have on two occasions run foxes to holes in old trees, which, from the marks round one of them, had evidently been occupied by the animal for long. Lizards are a favourite food with the fox, as well as rats, crabs, various insects, white ants, etc."

On account of not possessing the strong scent of its European relative, the Indian fox is but little hunted with hounds. It is, however, frequently coursed with greyhounds, when, from its numerous doubles, it gives a good run; pure-bred English greyhounds are, however, too fleet to give good sport, and either half-bred or Arabian or Persian dogs are in consequence generally employed. According to Jerdon, when the animal is going slowly or hunting for food, the tail is trailed on the ground; when running, it is stretched out horizontally; while during the doubling it is raised erect. The young are almost invariably four in number at a birth, and are produced during February, March, and April. The Indian fox is easily tamed, and in this state is more agreeable than most other foxes, owing to the absence of odour.

Neary Fox.

This fox (*C. canus*) is a still smaller species inhabiting Baluchistan and the southern parts of Afghanistan, and at present known in Europe by only three specimens. The length of the head and body is only 18 inches, and that of the unusually long tail from 15 to 16 inches. It is distinguished from the preceding species by the more ashy-grey tinge of its fur.

LONG-EARED FOXES (*Canis chama*, *zerda*, etc.).

The South African asse fox (*C. chama*) is the first of a group of four species from Africa, two of these being characterised by the extreme length of their ears. It is somewhat smaller than the common fox, but it has considerably longer ears, and therefore appears to form a kind of transition from the true foxes towards the fennecs. It is a yellowish-coloured animal, with some black hairs mingled with the light fur of the back, a black tip to the tail, and some chestnut splashes on the snout. It inhabits both sides of the Orange River in great and little Namaqualand, and extends eastwards to Kimberley.

Pale Fox.

This fox (*C. pallidus*) may be distinguished at a glance from the preceding, not only by its much smaller size, but likewise by its longer ears and the thinness of the tail. The general colour is a pale yellow, with a faint tinge of red; the tail having many black hairs among the lighter fur, a small dark spot on the upper-surface near the root, and a small black tip. In its smaller size and longer ears, this species approaches still closer to the fennecs. It comes from East and West Africa, having been obtained from Senegambia and Nubia and Kordofan.

Rüppell's Fennec.

Rüppell's fennec (*C. famelicus*) is distinguished from all the species hitherto noticed by the great length of its ears, although these are proportionately smaller than in the true fennec. It is a smaller animal than the pale fox, the length of the head and body being about 19 inches, and that of the tail $9\frac{1}{2}$ inches; while the ears measure just over 3 inches in length. This fox has a fawn-coloured head, reddish back, shoulders, and tail, greyish sides, and nearly white under-parts; but as it can be so easily recognised by its ears, it is unnecessary to devote further attention to its colouring. Rüppell's fennec was originally obtained from the Nubian deserts, but either this or a closely-allied species occurs in Syria and parts of Persia, as well as in Afghanistan.

Common Fennec.

The last and smallest representative of the genus *Canis* is the pretty little North African fennec (*C. zerda*), in which the total length of the head and body is only just over $15\frac{1}{2}$ inches, the tail measuring $6\frac{1}{2}$ inches, and the ears being at least 3 inches in length, and sometimes even more. The ears, being wide in proportion to their length, are of enormous size compared to the head, and thus communicate a remarkable physiognomy to the animal. The general colour of the fur of the upper-parts of the fennec varies from a pale fawn to buff, the under-parts being white, and the tip of the tail black; while there may be black markings on the upper part of the latter near its root. On the forehead and round the eyes the fur is nearly white; while the outer surfaces of the ears are rufous, and their inner margins have some long and nearly white hairs. Sometimes there is a black mark in the middle of the hinder-part of the back.



AFRICAN FENNECS

The fennec is confined to Northern Africa, ranging from Nubia to Algiers, and occurring over the whole of the Sahara Desert. It is essentially a desert animal, with the sands of which its pale coloration is in complete harmony; and it is likewise mainly nocturnal in its habits. Like the common fox, the fennec makes a burrow, which is generally situated in the neighbourhood of the tufts of low plants growing here and there in the desert; these plants rendering the soil more coherent, and therefore easier to burrow in. The inside of the burrow is lined with feathers, hair, and soft vegetable substances, and is remarkable for its cleanliness. The burrows are made with wonderful rapidity—so quickly, indeed, that the animal seems to sink into the ground as though it were diving into water; and when hunted the creature generally manages to escape by thus burrowing. During the day the fennec reposes in its burrow, with its head curled up beneath the bushy tail, and only the ears exposed. At the slightest sound or movement it is, however, on the alert; and, when thus disturbed, it utters a slight whimper, and soon endeavours to dispose itself again to slumber. At sunset the fennec leaves its burrow and makes for its drinking-place, but instead of going straight across the sand dunes, it always seeks the protection of such ravines and hollows as there may be. Around the drinking-places the moist earth is covered with countless impressions of its feet. After having satisfied its thirst, the fennec sets about seeking its food, which may be either jerboas, small birds, lizards, insects, or fruit.

The burrows are generally made near together, so that the fennecs live in small colonies or companies. According to native reports, the young are born in March, the number in a litter being either three or four.

THE CAPE HUNTING-DOG (*Lycan pictus*).

With the fennec we took leave of the last member of the family which can be included in the typical genus *Canis*, and we now come to the first of three species which represent as many distinct genera. The curious-looking animal depicted in the illustration on the next page, and commonly known as the Cape hunting-dog, differs from other members of the family in having but four toes to each foot, and also in its peculiar irregularly-spotted coloration. The number of the teeth is the same as in the wolf; and the skull has also a considerable resemblance to that of the latter, although shorter and broader; while the form of the cheek-teeth is likewise rather different. In point of size the hunting-dog may be compared with a tall greyhound. Its limbs are relatively long; the head is broad and flat, with a somewhat short muzzle, and rather large ears. The fur is rather thin; and is coloured with a mixture of black, yellowish ochre, grey, and white, the disposition of the colours varying greatly in different individuals, and the patches or blotches being generally arranged unsymmetrically on the two sides of the body. Professor Mivart describes the usual coloration as follows:—"The general ground-colour is an ochraceous grey, but with black markings, so that the body and outer sides of the extremities are blotched and brindled with black, intermingled here and there with white spots edged with black; the markings being very irregular. The muzzle is black, and a black stripe sometimes, but not always, passes backwards

from between the eyes and ears, and along the neck. The root of the tail is ochraceous, then more or less black, with the terminal portion white or whitish; it is rather bushy. The ears are said to be more or less naked; they are more or less black within, though with some white hairs, while externally they are of an ochre colour at their roots, above which they may or may not be black." In some specimens, the front of the fore-limbs is more or less marked with black. In the specimen here represented, the coloration is very irregular, there being a large amount of white on the under-surface. In others, however, the ochre colour is



CAPE HUNTING-DOG ($\frac{1}{2}$ nat. size).

predominant, and the black consists mainly of irregular spots, while there is scarcely any white. This animal inhabits nearly the whole of Africa to the southwards and eastwards of the Sahara.

The most remarkable feature about the hunting-dog is its superficial resemblance to the spotted hyæna of the same country; this being most noticeable in those individuals in which the ochre colour predominates, and the dark areas take the form of spots. From this resemblance, which is merely superficial and indicates no sort of affinity between the two animals, the hunting-dog is frequently termed the hyæna-dog. To account satisfactorily for this resemblance is very difficult. It has been suggested that it is a case of "mimicry"; that is to say, the resemblance to the

hyæna is due to some advantage which the hunting-dog thereby gains. It is, however, very difficult to see what advantage a strong animal hunting in packs, like the present species, can gain by being mistaken for a hyæna, as it is in every respect fully qualified to take care of itself. If, however, we could suppose that the hunting-dog was originally a solitary animal, which had subsequently become gregarious, then perhaps the resemblance to the hyæna might have been an advantage to it.

Although generally nocturnal, the hunting-dog may occasionally be seen during the day. One of the best accounts of its habits is given by Gordon Cumming, who writes as follows:—"The wild dogs, or *wilde honden*, as they are called by the Dutch boers, are still [about 1845] abundant in the precincts of the Cape Colony, and are met with in great numbers throughout the interior. These animals invariably hunt together in large organised packs, varying in number from ten to sixty, and by their extraordinary powers of endurance, and mode of mutual assistance, they are enabled to run into the swiftest or overcome the largest and most powerful antelope. I have never heard of them attacking the buffalo, and I believe that the animal pursued in the present instance [a *gnu*] is the largest to which they give battle. Their pace is a long never-tiring gallop, and in the chase they relieve one another, the leading hounds falling to the rear when fatigued, when others, who have been husbanding their strength, come up and relieve them. Having succeeded in bringing their quarry to bay, they all surround him, and he is immediately dragged to the ground, and in a few minutes torn to pieces and consumed. They are of a bold and daring disposition, and do not entertain much fear of man, evincing less concern on his approach than any other carnivorous animal with which I am acquainted. On disturbing a pack, they trot leisurely along before the intruder, repeatedly halting and looking back at him. The females bring forth their young in large holes, in desolate open plains. These burrows are connected with one another underground. When a troop of wild dogs frequenting these holes observes a man approaching they do not, as might be supposed, take shelter in the holes, but rather trusting to their speed, they rush forth, even though the intruder should be close upon them, and retreat across the plain, the young ones, unless very weak, accompanying them. The devastation occasioned by them among the flocks of the Dutch boers is inconceivable. It constantly happens that when the careless shepherds leave their charge, in quest of honey or other amusement, a pack of these marauders comes across the defenceless flock. A sanguinary massacre in such cases invariably ensues, and incredible numbers of sheep are killed and wounded. The voracious pack, not content with killing as many as they can eat, follow resolutely on, tearing and mangling all that come within their reach. Their voice consists of three different kinds of cry, each being used on special occasions. One of these cries is a short angry bark, usually uttered when they behold an object which they cannot make out. Another resembles a number of monkeys chattering together, or men conversing together when their teeth are chattering violently from cold. This cry is emitted at night, when large numbers of them are together, and they are excited by any particular occurrence, such as being barked at by domestic dogs. The third cry resembles the second note uttered by the cuckoo which visits our islands during the summer months, and, when

heard in a calm morning echoing through the distant woodlands, has a very pleasing effect." From later accounts it would appear that the holes referred to above are inhabited by the hunting-dogs only during the breeding-season, and that they are not excavated by the animals themselves.

The numbers in which these dogs were formerly wont to associate together is illustrated by the following anecdote from the writer just quoted. Being suddenly wakened from slumber one night, the great hunter states that "I heard the rushing of light feet as of a pack of wolves close on every side of me, accompanied by the most unearthly sounds. On raising my head, to my utter horror, I saw on every side nothing but savage wild dogs, chattering and growling. On my right and on



HUNTING-DOGS CHASING GEMSBOK.

my left, and within a few paces of me, stood two lines of these ferocious-looking animals, cocking their ears and stretching their necks to have a look at me; while two large troops, in which there were at least forty of them, kept dashing backwards across my view, within a few yards of me, chattering and growling with the most extraordinary volubility. Another troop of wild dogs were fighting over the wildebeest I had shot, which they had begun to devour. On beholding them I expected no other fate than to be instantly torn to pieces and consumed. . . . However, I had presence of mind to consider that the human voice and a determined bearing might overawe them, and accordingly, springing to my feet, I stepped on the little ledge surrounding the hole, while, drawing myself to my full height, I waved my large blanket with both hands, at the same time addressing my savage assembly in a loud and solemn manner. This had the desired effect; the wild dogs removed to a more respectful distance, barking at me something like collies."

Probably a sight like this cannot at the present day be witnessed, although hunting-dogs are still numerous in the Kilima-njaro district. Of scarcely less interest than these large assemblies must, however, be the spectacle of two or more of these animals in full pursuit of an antelope. Such a hunt was witnessed by Mr. Selous in Bechuanaland, the pursued being a male sable antelope, and the pursuer a single hunting-dog. This hunter and his comrades had been for some time watching the antelope, when suddenly it started off full in their direction. On looking round for the cause of this sudden movement, "we saw," writes Mr. Selous, "that an animal was running on its track, and, although still distant, was overhauling it fast, for the sable antelope not being pressed was not yet doing its best, so that when it was about two hundred yards from us, its pursuer, which we now saw was a wild dog, was not more than fifty yards behind us. The noble-looking antelope must just then have seen us, for it halted, looked towards us, and then turning its head glanced at its insignificant pursuer. That glance, however, at the open-mouthed dog thirsting for its life-blood must have called unpleasant reminiscences, for instead of showing fight, as I should have expected it to have done, it threw out its limbs convulsively, and came dashing past us at its utmost speed. It was, however, to no purpose, for the wild dog lying flat to the ground as a greyhound, its bushy tail stretched straight behind it, covered two yards to its one, and came up to it in no time. It just gave the antelope one bite in the flank, and letting go its hold instantly fell a few yards behind; at the bite the sable antelope swerved towards us, and upon receiving a second in exactly the same place, turned still more, so that, taking the point on which we stood as centre, both pursuer and pursued had described about half a circle round us, always within two hundred yards, since the sable antelope had first halted. As the wild dog was just going up the third time it got our wind, and instead of again inflicting a bite stopped dead and looked toward us, whilst about a hundred yards from it the sable antelope also came to a stand. The baffled hound then turned round, and made off one way, while the sable antelope, delivered from its tormentor, cantered off in another." Mr. Selous adds that this is the only instance known to him of a hunting-dog pursuing an animal by itself.

In the form of the last premolar tooth of the lower jaw the skull of the hunting-dog presents a peculiarity by which it can be distinguished from that of the wolves; and it is remarkable that a lower jaw from a cave of Glamorganshire shows the same peculiarity in the tooth in question, thus indicating that during the mammoth age a hunting-dog, nearly allied to the living African species, pursued its prey on the Mendips.

THE BUSH-DOG (*Iticyn venaticus*).

The bush-dog of Brazil and British Guiana is an animal of or about the size of a fox, differing from all the other members of the family in external appearance, although it is not on this ground that it is separated from *Canis*. It is a short-eared, short-legged, and long-bodied animal, with a very deep and rather elongated neck, and of a general dark brown colour. The head, neck, and shoulders, differ from the general body-colour in being grey, while the hind-quarters, tail, and

under-parts are nearly black. The great peculiarity of this animal is, however, the circumstance that it has usually but one molar tooth in the upper jaw, and only two of these teeth in the lower jaw, so that it has fewer teeth than any other member of the dog family. This, however, is not all, for the lower flesh-tooth has no trace of the cusp found on the inner side of the blade in all other dogs; while the heel of the same tooth, instead of being broad and adapted for grinding, is brought to a sharp cutting-edge. These features indicate that the bush-dog is a more specialised animal than the other members of the family.

But little is known of the habits of the bush-dog in the wild state, as it is but seldom seen, and is probably nocturnal. We are informed, however, that these animals are, for their size, very fierce, and hunt in packs. They are found only in the interior of the countries they inhabit; and are said to take readily to the water. A specimen kept in captivity was very indiscriminate in its feeding, but preferred animal to vegetable substances. Fossil remains of the bush-dog are found in the caverns of Brazil, in company with those of a host of strange animals long since passed away.

LALANDE'S DOG (*Otocyon megalotis*).

As the bush-dog is remarkable for the diminution in the number of its teeth, so the long-eared, or Lalande's dog, is peculiar in that it has more than the ordinary



LALANDE'S DOG (½ nat. size).

complement of these organs. Thus, while in the lower jaw this animal has invariably four molar teeth, or one more than in any other member of the family, in the upper jaw it has either three or four of these teeth, whereas in all other living canine animals there are not more than two upper molars. The total number of teeth is accordingly either forty-six or forty-eight; and no other Mammal outside the Marsupial order ever has four molar teeth in both jaws. Indeed, the tenrec is the only one in which there are four of these teeth even in one jaw. Lalande's dog is, therefore, a very interesting animal, and one which retains, perhaps, traces of a Marsupial ancestry lost in other living Mammals, except the tenrec. This species, which is rather smaller than a common fox, comes nearest in external appearance to the fennecs, having enormous ears and a thick bushy tail. The eyes are unusually large; the limbs are relatively longer than in the fox, but the tail is proportionately shorter. The general colour of the fur is brownish or iron grey, mottled with yellow; the outer sides of the limbs being nearly black, the under-parts whitish, and the tail slaty grey, with a black tip, and more or less distinct dark markings on its upper-surface. These animals are natives of South and East Africa; but very little is known of their habits. They are generally found in open country, dwelling under or among small bushes, and going about in pairs. Although they are said to stand and watch the hunters by the hour together, they are very difficult of approach.

EXTINCT DOGS.

It has been mentioned that fossil remains of several living members of the dog family have been obtained from the superficial deposits of the countries which they severally inhabit. It has also been mentioned that extinct species of the Asiatic wild dogs and of the African hunting-dog have been found in Europe, thus indicating for those two groups a former distribution of wider extent than at present. A number of extinct species belonging to the genus *Canis* have also been obtained from the Pliocene and upper-half of the Miocene deposits of different parts of the world. These, however, are all more or less closely allied to living species, and are accordingly of no very special interest to the evolutionist.

On the other hand, if we go somewhat further back in the geological record, to the lower portion of the Miocene and the upper part of the Eocene period, we come across remains of more or less decidedly dog-like animals widely different from living forms. Some of these extinct creatures are, indeed, to a considerable extent, intermediate between dogs and civets; and thus indicate that the civet family is probably derived from the ancestors of the dog family. This enlarges our view of the relationships of the various modern Carnivores to one another, for we have already shown that the hyænas are closely related to the ancestral civets, and the cats are probably another side-branch nearly allied to them. We thus have reason to believe that all the Carnivores with bladder-like tympanic bullæ to their skulls—namely, cats, civets, hyænas, and dogs—have sprung from a common ancestral stock nearly allied to the modern dogs. The most civet-like of these intermediate extinct animals are known by the name of *Cynodictis*, and they were mostly creatures of about the size of the fox, with teeth either numerically the same as in the latter, or as in the civet, and with plantigrade feet.

Far more remarkable is, however, the connection which is shown to exist by these fossil types between the dogs and the bears, which are now so widely sundered. The connecting type appears to be a creature known as the *Amphicyon*, of which a lower flesh-tooth is shown on p. 353. Some of these *amphicyons* were not larger than a fox, while others must have fully equalled a bear in size. They differed from modern dogs in having forty-four teeth, owing to the presence of the third pair of molars in the upper-jaw, and also in that their feet were plantigrade, like those of a bear; while they had five toes on all feet. The teeth of these plantigrade dogs, as they may be called, were, indeed, essentially those of a modern dog; but, as we shall show later on, there is a complete transition through other extinct forms to those of the bears. Hence we conclude that these plantigrade dogs were not only the ancestors of the modern dogs, but likewise gave origin to the bear family. The dog family is, therefore, the most ancient type of Carnivores now living, and the one which includes the extinct forms from which nearly all the others have originated.



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